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ABSTRACT

This student manual is concerned with the practical application of mathematics as used by masons. The manual's design allows students to work at their own pace. Included in each of the five units are individual lesson sheets with written instructions and explanations. Each information sheet states that topic's objectives, information about the topic, examples of procedures, and problems for the student to solve. Unit 1, decimal fractions, contains problems in addition, subtraction, multiplication, division, decimals on the electronic calculator, percents to decimals, fraction equivalents, and multiplication and divison by percents. Unit 2 contains problems on rounding off numbers. Unit 3, fractions, contains problems in addition, adding fractions on the calculator, dimensions-addition, adding dimensions on the calculator, converting fractional part of a foot to inches, subtraction of fractional dimensions, subtraction of dimensions on the calculator, and multiplication and division of fractions. Unit 4, square measure, contains problems concerning areas and perimeters of squares, rectangles, triangles, and circles; areas of walls and ceilings; and areas of solid geometric figures. Unit 5, cubic measure, contains problems in computing volumes of cubes, rectangular prisms, and walls; quantities of materials (brick, mortar, stone); footings; volumes of cylinders and triangular prisms; and the cubic yards of concrete floors, walks, and patios. Unit tests are provided at the end of the manual (answers are not provided). (CT)

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State of New Jersey
Department of Education
Division of Vocational Education

MATH FOR MASONS

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Preface to the Revised Edition

When this book was first published, facility in the use of fractions was required for the many estimating jobs required of masons.

Today anyone who must work with figures carries an electronic hand calculator. As a consequence, although instruction in the use of fractions is included in this revised edition, emphasis has shifted to the use of decimals. The student is urged to memorize the decimal equivalents of the fractions frequently encountered, so as to take full advantage of the speed, accuracy, and ease of use of the calculator.

Material has also been added on the subject of rounding off answers.

The Vocational-Technical Curriculum Laboratory publishes a manual "Your Electronic Hand Calculator – How To Get the Most Out of It." This gives step-by-step instructions in using the various function keys on a calculator, and includes a great many problems (with answers) designed to develop familiarity with the machine and its capabilities.

This revision was made by the staff of the Vocational-Technical Curriculum Laboratory.

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To the Student

Back in the beginning of brickmaking and bricklaying, when builders had to make their own materials, they had to know how many bricks and how much mortar they would need. Builders could not hop into their pick-up trucks and go to the nearest supply yard when they ran short of material. They had to stop building and make more of what was needed. If builders made more than they needed, they were stuck with it. There were very few nearby customers for masonry materials in those days, so whether builders made too much or too little, they lost time and did unnecessary extra work.

The situation is not too different today. In order to erect a building quickly, easily, and economically, we must know how to figure exactly how much material we will need. If we do not or cannot estimate our needs accurately, we will lose time and do extra work – which means losing money. In short, *you can make more money if you learn to figure accurately.*

What you do with your head, you don't have to do with your back.

In the Masonry class you will work from individual lesson sheets. You will learn to do your work by following written instructions and explanations. No daily assignments will be made. As you complete each assignment, you will start on the next one. There will be no waiting for some students in the class to learn a certain lesson before you can go ahead with a more advanced lesson. Each student can go according to his/her capability.

It is assumed that you have (or can borrow) an electronic calculator. It will pay you well to become thoroughly familiar with it. Learn how it can do "chain" multiplication and division problems for you, how you work percent problems on it, and how you use its "memory." You will never be sorry that you put a little effort into this, for it will save you countless hours of figuring, and no doubt many mistakes as well.

RULES

1. Be sure you read the instructions and explanations carefully and understand them completely.

2. Check with your instructor if you are not sure about how to do the problem. It is better to be sure and do it right than to do it wrong and have to unlearn the wrong way.
   CAUTION: Do not wear a path to the teacher's desk.
   Others need help also.

3. Be sure that you understand each step in a problem.

4. **Do your own work.** You cannot learn by copying. You only cheat yourself and keep yourself from learning as quickly as you are able.

5. If you do not use a calculator, problems must be completely worked out on the worksheet which you turn in. When you use a calculator, the final answer will be enough.

6. All assignments will be graded for neatness as well as for accuracy. Those failing in neatness will be returned to be done over.

7. At the top of each assignment you will write:

   Your Name Unit # Assignment # and the date.

UNIT I - DECIMAL FRACTIONS

Review of Meaning of Decimals **Information Sheet No. 1**

OBJECTIVES: To review the concept of decimal fractions.
To learn to convert common fractions to decimal fractions, and decimal fractions to common fractions.

INFORMATION:

A decimal fraction is one which has no written denominator. The denominator of a decimal fraction is understood to be 10, or 10 multiplied by itself one or more times. The denominator of a decimal fraction is given by the *position of the decimal point*. There are as many zeros in the denominator as there are numbers to the right of the decimal point. Numbers to the left of the decimal point are whole numbers.

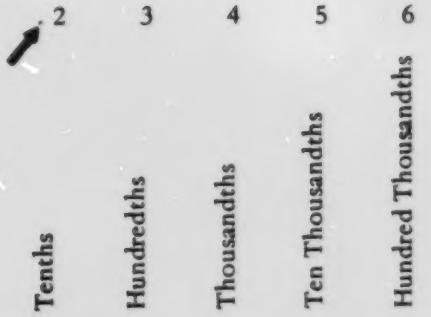
Decimal Fraction		Common Fraction
.2	=	$\frac{2}{10}$ Two tenths
1.06	=	$1\frac{6}{100}$ One and six hundredths
25.159	=	$25\frac{159}{1000}$ Twenty-five and one hundred fifty-nine thousandths

You will need to know how to add, subtract, multiply, and divide decimal fractions. You add, subtract, multiply and divide decimal fractions exactly as you do whole numbers, BUT you must be certain to put the **decimal point** in the right place throughout your work and in the answer.

Here is a list of some of the common fractions and their decimal equivalents. As you can see, the decimal equivalents can be obtained by actually dividing the denominator of the fraction into the numerator.

$\frac{1}{2}$ = .5	$2\overline{)1.0}$	.5
$\frac{1}{4}$ = .25	$4\overline{)1.00}$	.25
$\frac{1}{5}$ = .2	$5\overline{)1.0}$	.2
$\frac{1}{6}$ = .167	$6\overline{)1.000}$	$.166\frac{2}{3}$ = .167
$\frac{1}{8}$ = .125	$8\overline{)1.000}$	.125
$\frac{1}{10}$ = .1	$10\overline{)1.0}$	.1

Decimal values:



OBJECTIVE: To learn how to add decimals.

INFORMATION:

Adding decimals is just like adding whole numbers except that you must keep all the decimal points directly under each other in a straight line. If you do not list each number properly you will arrive at the wrong answer.

ADD: 6.1 + 362.007 + 23.12 + .86

If you cannot keep the numbers in their proper laces, draw a line as a guide.

Be sure to put the decimal point of your answer in the right place **before** you add.

```
  6.1
362.007
 23.12
   .86
-------
392.087   ANS.
```

OBJECTIVE: To learn how to subtract decimals.

INFORMATION:

Subtracting decimals is just like subtracting whole numbers. **BUT** – be certain that the numbers are listed with the decimal points directly in line with each other.

SUBTRACT: 12.56 − 8.29 =

List correctly. Place decimal point of the answer in the proper place before subtracting.

$$\begin{array}{r} 12.56 \\ -\ 8.29 \\ \hline 4.27 \end{array}$$ ANS.

SUBTRACT: 18.6 − 12.43 =

List correctly. Having only 1 decimal place in the top number you have nothing from which to subtract the 3, so you add a zero to the right of the .6 making it .60. This does not change the value of the decimal ($\frac{60}{100} = \frac{6}{10}$) and now you can subtract to get the correct answer.

$$\begin{array}{r} 18.6 \\ -\ 12.43 \\ \hline \end{array}$$

$$\begin{array}{r} 18.60 \\ -\ 12.43 \\ \hline 6.17 \end{array}$$ ANS.

SUBTRACT: 21.58 − 14.7 =

List correctly. Having 2 decimal places in the top number and only one in the bottom number, subtract as though there were a zero after the 7. Watch the decimal point.

$$\begin{array}{r} 21.58 \\ -\ 14.7 \\ \hline 6.88 \end{array}$$ ANS.

Follow the directions on Information Sheets 1, 2, and 3. List all numbers clearly, neatly and correctly. Be sure the decimal point is in the right place.

ADD:

1. .97 + 8.5 + 12.06 + .469 =
2. 9 + 6.15 + 11.869 + .7 =
3. .6 + 9.07 + 2.4 + 12.156 =
4. 123.3 + .775 + 26.9 + 1.23 + 14.246 =
5. 1.587 + 201.6 + .075 + 2.67 + 101.369 =
6. .69 + 17.874 + 1,828.25 + 13.3 + 9.99 =
7. 3.6 + 137.586 + 6.459 + 32.2 + 2,658.877 =
8. 47.4 + 6.579 + 1,825.6 + 39.85 + 4.327 =
9. 152.3 + 7.355 + 18.7 + 3,429.86 + 76.59 =
10. .08 + 6.763 + 125.68 + 7.9 + 2.318 =

SUBTRACT:

11. 23.05 − 16.6 =
12. 71.6 − 14.74 =
13. 6.783 − 2.867 =
14. 125.4 − 10.689 =
15. 17.66 − 8.4 =
16. 23.845 − 16.5 =
17. 5.89 − 3.799 =
18. 1,447.62 − 758.673 =
19. 12.357 − 3.45 =
20. 16.791 − 6.26 =

Change the following fractions to decimals:

21. $\frac{1}{4}$
22. $\frac{1}{10}$
23. $\frac{2}{5}$
24. $\frac{1}{8}$
25. $\frac{9}{10}$
26. $\frac{1}{3}$
27. $\frac{7}{8}$
28. $\frac{2}{3}$
29. $\frac{3}{4}$
30. $\frac{1}{2}$
31. $\frac{7}{10}$
32. $1\frac{3}{5}$
33. $6\frac{1}{8}$
34. $3\frac{1}{3}$
35. $10\frac{3}{100}$

Change the following decimals to fractions. Reduce to lowest terms.

36. .5
37. .75
38. .06
39. .125
40. .6
41. .45
42. .07
43. .625
44. 1.68
45. .4
46. .65
47. 2.75
48. 13.05
49. 6.98
50. 10.15

OBJECTIVE: To learn the right way to multiply decimals.

INFORMATION:

To multiply decimals, again you must be careful to list your numbers neatly and correctly. You do not list the decimals so that the decimal points line up. Instead you place the numbers of the multiplier under the multiplicand starting at the right and working to the left.

2.895 X 3.2 is written:

2.895 (multiplicand)
X 3.2 (multiplier)

17.2 X .46 is written:

17.2 (multiplicand)
X .46 (multiplier)

You multiply just as for whole numbers, and when you have the answer you must place the decimal point in the right place. The important point to learn in multiplication is to get the right number of decimal places in the answer.

PROBLEM: 2.895 X 3.2

To determine the number of decimal places in your answer, you add the number of decimal places in the multiplicand (3) and the multiplier (1). 3 + 1 = 4.

2.895 (multiplicand)
X 3.2 (multiplier)
5790
8685
9.2640 ANS.

Starting at the right in your answer, count off 4 places toward the left. Put the decimal point in front of the 4th number. To make a rough check on your answer, multiply the whole numbers in the problem and compare this with the answer. If the 2 results are reasonably close, you have the decimal point in the right place.

Follow the instructions on Information Sheet No. 4. List your figures neatly and clearly. Check each problem for accuracy. Be sure you place the decimal points properly and so that they can be seen easily.

MULTIPLY:

1. 1.47 X 7 =
2. 382 X .08 =
3. 840 X .005 =
4. .006 X .07 =
5. 1.56 X 7.2 =
6. 7.071 X 9 =
7. 12.4 X 3.5 =
8. 65.1 X 2.7 =
9. 3.08 X .45 =
10. 1.63 X 4.3 =
11. .6 X 5 =
12. .04 X .7 =
13. 875 X .016 =
14. 24.56 X 4.31 =
15. 17 X $40.83 =
16. 34 X $4.85 =
17. .41 X 51.2 =
18. 16 X $.79 =
19. .008 X 9.48 =
20. .512 X .305 =
21. $3.78 X 17.5 =
22. .9 X 3.33 =
23. 17.25 X $14.40 =
24. 238.5 X .12 =
25. 1.98 X 20.5 =

OBJECTIVE: To learn the proper way to divide decimals.

INFORMATION:

In dividing decimals, it is most important to place the decimal point in the right place.

There are different kinds of division problems involving decimals, as you will see. But in all kinds, the most important point is the placing of the decimal point.

PROBLEM: 16.5 ÷ 6 =

When you divide a decimal by a whole number you place the decimal point in the answer directly above the decimal point in the dividend.

(Decimal point)
↓
2.75 (Answer)
(Divisor) 6) 16.5 (Dividend)

To check your answer you multiply your answer by the divisor. This should be the same as the dividend.

2.75 (Answer)
× 6 (Divisor)
16.50 (Dividend)

PROBLEM: 16.5 ÷ 4.4 =

(A decimal divided by a decimal). Move the decimal point to the right one place in both the dividend and the divisor. Your dividend will then be 165. The decimal point in your answer will be directly above the decimal point which you moved behind the 5. Since 44 will not divide evenly into 165, you add 0's to the right of the decimal point in the dividend to get your answer.

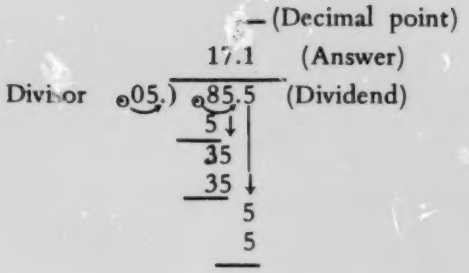
Decimal point
↓
3.75 (Answer)
(Divisor) 44) 165.00 (Dividend)
132
330
308
220
220

Check your answer:

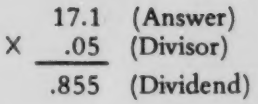
3.75 (Answer)
× 4.4 (Divisor)
1500
1500
16.500 (Dividend)

PROBLEM: .855 ÷ .05 =

Before you divide, you must move the decimal point in both divisor and dividend 2 places to the right. This changes .855 to 85.5, and .05 to 5. The decimal point in the answer is directly above the new position of the decimal point in the dividend.

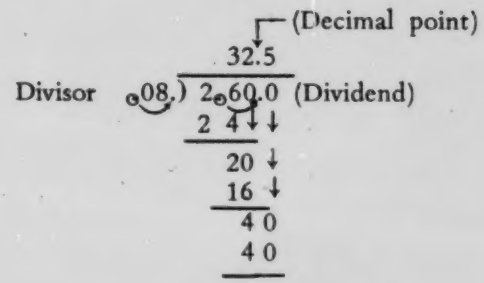


Check your answer.

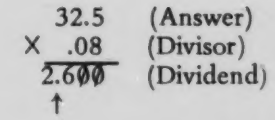


PROBLEM: 2.6 ÷ .08 =

The divisor has 2 decimal places and the dividend only 1. Before you can more the decimal point you must place a zero after the six. Then move the decimal point 2 places to the right in both the divisor and the dividend. In order to complete the division, you will find it necessary to add a zero to the right of the decimal point in the dividend. The decimal point in the answer is directly above the new position of the decimal point in the dividend.



Check your answer.



In all the sample problems, you will note that the same general procedure was followed. First the divisor was changed to a **whole number**. Then the decimal point in the dividend was moved to the right as many places as it was necessary to move the decimal point in the divisor. So long as you move both decimal points the **same number of places** to the right, you do not change the value of the division problem, and your answer should be correct.

Follow the directions on Information Sheet No. 5. Be sure the decimal point is in the right place. Carry out your answer to 3 decimal places where necessary. Remember to check your answers.

DIVIDE:

1. .72 ÷ .6 =
2. 2.55 ÷ 3 =
3. 16.75 ÷ .5 =
4. .9984 ÷ 3.84 =
5. 60.8 ÷ .008 =
6. 1.026 ÷ .19 =
7. 18.99 ÷ 1.5 =
8. 888 ÷ .048 =
9. 150 ÷ 5.5 =
10. 240 ÷ 6.75 =
11. 48 ÷ 2.5 =
12. 63 ÷ 4.25 =
13. 58 ÷ 6.8 =
14. 75.5 ÷ 6 =
15. 18.5 ÷ 2.25 =
16. 27 ÷ 1.5 =
17. 32 ÷ 3.8 =
18. 29 ÷ 2.3 =
19. 15.6 ÷ 1.4 =
20. 21.5 ÷ 2.25 =

OBJECTIVE: To learn how to enter and read decimals on an electronic calculator.

INFORMATION:

Almost all calculators have what is called a floating decimal point. This means that the position of the decimal point may come at the end of a number, at the beginning of a number, or anywhere in between – wherever you press the decimal-point key on the machine.

In contrast, some calculators can be set to put the decimal point in a fixed spot, as, for example, before the "cents" place in dollars and cents. Then the decimal-point key does not have to be pressed when the number is entered.

We will assume that you have the use of a calculator with a floating decimal point.

(1) Every whole number has a decimal point *understood* at the end of the number. If you enter a whole number, the machine will automatically put the decimal point after the number. To enter the number 123,

Enter: 1, 2, 3 Display: 123.

(2) If the number has a decimal point, press the decimal-point key in the proper order. To enter 59.09,

Enter: 5, 9, ., 0, 9 Display: 59.09

(3) It is not necessary to enter a final zero *after* a decimal point. To enter $23.40,

Enter: 2, 3, ., 4 Display: 23.4

The machine will work with this number in the same way as it would work with 23.40.

(4) It *is* necessary to enter all zeros *before* a decimal point. For example, to enter the number 2050,

Enter: 2, 0, 5, 0 Display: 2050.

(5) The machine will add, subtract, multiply, or divide your entries correctly, and *place the decimal point correctly* in the answer.

Example: 15 x $3.80
Enter: 1, 5, x, 3, ., 8, = Display: 57.

Since you are working with money, you know that the correct answer is $57.00.

A. Enter the following numbers on an electronic calculator. If you are not sure how any of them should be entered, check with your teacher.

1. 251
2. 9.097
3. $34
4. $34.10
5. .02
6. 15 cents
7. 1270
8. 3.1416
9. Ten dollars and 2 cents
10. 14,600

B. Go back to Assignment Sheets 1, 2, and 3 and check all your answers by doing the same problems on a calculator.

OBJECTIVE: To learn the meaning of percent.

INFORMATION:

Just what does "percent" really mean?

Actually, it means "for each hundred." In other words, 5% means 5 out of every 100; 40% means 40 out of every 100, and so on.

So if we say, for example, that 75% of the students in this school are expected to graduate, it means that, out of every 100 students who enter, 75 will later graduate. Or if we say "20% off the price," it means that 20 dollars will be taken off every 100 dollars. (Or 20 cents off every 100 cents.) A 10% increase in price means that the price went up $10 for every $100 it cost originally. (Or 10 cents for every 100 cents.)

In business particularly, percent calculations are very important, although in everyday living we also see and use percents constantly. Percents are used to figure:

1. **Interest** payments when you borrow or lend money, or buy goods "on time."
2. **Discounts** off the price of goods for paying promptly, or for buying sale merchandise, or for buying a large amount, or for being a favored customer.
3. **Commissions** paid to salesmen.
4. **Tips** paid for services.
5. **Taxes** paid the government on income, value of property, etc.
6. Cost of living figures, employment figures, government budget charts, etc., etc.
7. Relating numbers to each other in countless ways in business, industry, sports.

OBJECTIVE: To learn how to change percents to decimals.

INFORMATION:

To work problems, *percents must be changed first to either decimals or fractions.* For calculator use, percents are changed to decimals (unless the calculator has a special percent key). First we will learn to change percents to decimals.

The fact that a percent means "out of each hundred" gives us our clue to changing a percent to a decimal. We will divide the percent by 100.

$10\% = 10 \text{ out of } 100 = \frac{10}{100} = .10. = .10$

$24\% = 24 \text{ out of } 100 = \frac{24}{100} = .24. = .24$

$3\% = 3 \text{ out of } 100 = \frac{3}{100} = .03. = .03$

In each case, you will note, we dropped the percent sign when we divided by 100.

> To change from a percent to a decimal:
> Move the decimal point two places to the left and drop the percent sign.

Example A: Change 60% to a decimal.

Step I	60%	Write the problem.
Step II	60.%	The decimal point, if not shown, is understood to be to the right of the number.
Step III	.60. .60 Answer	Move the decimal point two places to the left and drop the percent sign.

Example B: Change 66.67% to a decimal.

Step I	66.67%	Write the problem.
Step II	.66.67 = .6667	Move the decimal point two places to the left and drop the percent sign.

Example C: Change $33\frac{1}{3}$ % to a decimal

Step I	$33\frac{1}{3}$%	Write the problem.
Step II	33.33%	Change the fraction to a decimal.
Step III	.33.33 = .3333	Move the decimal point two places to the left and drop the percent sign.

Solve the problems below by following the instructions on Information Sheet No. 8.

Change the following percents to decimals. (If the percent contains a fraction, change the fraction to a decimal first.)

1. 6%
2. 10%
3. 25%
4. 30%
5. 2%
6. 75%
7. 60%
8. $33\frac{1}{3}\%$
9. $2\frac{1}{2}\%$
10. 12.5%
11. 125%
12. 250%

Change the following percents to decimals.

13. 5%
14. 15%
15. $12\frac{1}{2}\%$
16. 65%
17. 17.5%
18. $3\frac{1}{2}\%$
19. $7\frac{1}{2}\%$
20. 4%
21. $6\frac{3}{4}\%$
22. 78%
23. 100%
24. 175%
25. 1%

OBJECTIVE: To learn to change percents to common fractions.
To learn the percent and decimal equivalents of the most common fractions.

INFORMATION:

Most percents are easily changed directly to fractions, although a few are easier to change to decimals first. Remember that "percent" means "out of a hundred."

Example A: Change 25% to a fraction.

Step I	25%	Write the problem.
Step II	$\frac{25}{100}$	25% means 25 out of 100, or $\frac{25}{100}$
Step III	$\frac{25 \div 25}{100 \div 25} = \frac{1}{4}$ Ans.	Reduce to lowest terms.

Example B: Change 37½% to a fraction.

Step I	37½%	Write the problem. Because of the fraction ½, it is easier to change 37½% to a decimal first.
Step II	37½% = 37.5%	First change ½ to .5, as in the previous lesson.
Step III	37.5% = .37.5 = .375	Change the percent to a decimal.
Step IV	$\frac{375}{1000}$	Change the decimal to a fraction.
Step V	$\frac{375}{1000} \div \frac{25}{25} = \frac{15}{40} = \frac{3}{8}$ Ans.	Reduce the fraction.

Certain common fractions, decimals, and percents pop up very often whenever figures are used. You can save a great deal of time if you memorize them. Even if you never leave home without a pocket calculator, you still need to be able to convert percents and fractions to decimals, because decimals are the "language" of calculators. So, to make the rest of your work in this math course easier, as well as all your estimating work in the future, memorize the chart on the next page.

Table of Equivalents

Fraction – Percent – Decimal

$\frac{1}{2}$	=	50%	=	.5	$\frac{1}{8}$	=	12½%	=	.125	$\frac{1}{10}$	=	10%	=	.1
$\frac{1}{3}$	=	$33\frac{1}{3}\%$	=	.333	$\frac{1}{4}$	=	25%	=	.25	$\frac{1}{5}$	=	20%	=	.2
$\frac{2}{3}$	=	$66\frac{2}{3}\%$	=	.667	$\frac{3}{8}$	=	37½%	=	.375	$\frac{3}{10}$	=	30%	=	.3
					$\frac{5}{8}$	=	62½%	=	.625	$\frac{2}{5}$	=	40%	=	.4
					$\frac{3}{4}$	=	75%	=	.75	$\frac{3}{5}$	=	60%	=	.6
					$\frac{7}{8}$	=	87½%	=	.875	$\frac{7}{10}$	=	70%	=	.7
										$\frac{4}{5}$	=	80%	=	.8
										$\frac{9}{10}$	=	90%	=	.9

A. Change the following percents to fractions. Reduce to lowest terms wherever possible.

1. 10%
2. 35%
3. 60%
4. 4%
5. 40%
6. 50%
7. 75%
8. 87½%
9. 39%
10. 78%
11. 125%
12. 80%
13. 150%
14. 5%
15. 62½%
16. 16%
17. 2%
18. ½%
19. 200%
20. ¼%
21. 12½%

B. Fill in the missing spaces in the following chart. Where you have not memorized the equivalent, work it out by the way that you have found easiest.

	Common Fraction	Decimal Equivalent	Percent	Common Fraction	Decimal Equivalent	Percent
(1)	$\frac{1}{4}$	.25	25%	(15)		15%
(2)	$\frac{1}{6}$		$16\frac{2}{3}\%$	(16)	.75	
(3)	$\frac{3}{5}$			(17) $\frac{2}{3}$		
(4)	$\frac{1}{8}$			(18)	.375	
(5)	$\frac{3}{16}$		$18\frac{3}{4}\%$	(19)		2%
(6)	$\frac{1}{3}$			(20)		9%
(7)		.3		(21)		62½%
(8)		.65		(22) $\frac{4}{5}$		
(9)		.05		(23)		56%
(10)			50%	(24)	.04	
(11)		.8		(25)		60%
(12)			20%	(26) $\frac{5}{6}$		
(13)		.125		(27) $\frac{7}{8}$		
(14)	$\frac{2}{5}$			(28)	.9	

More Equivalents
(Parts of a Foot) **Information Sheet No. 10**

OBJECTIVE: To learn fractional and decimal equivalents of parts of a foot.

INFORMATION:

As you know, many items used in masonry are not "even" parts of a foot. For example, what part of a foot is the 8-inch length of a brick?

There are 12 inches in a foot, so the 8 inches is

$$\frac{8}{12} = \frac{2}{3} = .667$$

If you have to estimate an area that involves parts of a foot, you will want to know the fractional and decimal equivalents of those parts.

Below is another table that you should become familiar with. It contains only a few numbers that you have not already memorized. The starred ones are the most important ones.

Remember – if you are going to work problems on your calculator, you will have to express fractional parts of a foot in decimals.

1″	=	$\frac{1}{12}$	=			.083′
2″	=	$\frac{2}{12}$	=	$\frac{1}{6}$	=	.167′
*3″	=	$\frac{3}{12}$	=	$\frac{1}{4}$	=	.25′
*4″	=	$\frac{4}{12}$	=	$\frac{1}{3}$	=	.333′
5″	=	$\frac{5}{12}$	=			.417′
*6″	=	$\frac{6}{12}$	=	$\frac{1}{2}$	=	.5′

7″	=	$\frac{7}{12}$	=			.583′
*8″	=	$\frac{8}{12}$	=	$\frac{2}{3}$	=	.667′
*9″	=	$\frac{9}{12}$	=	$\frac{3}{4}$	=	.75′
10″	=	$\frac{10}{12}$	=	$\frac{5}{6}$	=	.833′
11″	=	$\frac{11}{12}$	=			.917′
12″	=	$\frac{12}{12}$	=			1.′

If you forget an equivalent, all you have to do is divide out the fraction – either with pencil and paper or on your calculator.

More Equivalents
(Parts of a Foot) **Assignment Sheet No. 7**

Supply the decimal equivalents of the following lengths. Do as many from memory as you can.

1.	8″	16.	12′ 1″
2.	6″	17.	5′ 8″
3.	9″	18.	11′ 3″
4.	1″	19.	24′ 9″
5.	5″	20.	6′ 4″
6.	7″	21.	10′ 6″
7.	3″	22.	18′ 5″
8.	11″	23.	22′ 4″
9.	4″	24.	2′ 3″
10.	2″	25.	3′ 9″
11.	10″	26.	7′ 8″
12.	3′ 6″	27.	6′ 9″
13.	10′ 4″	28.	29′ 4″
14.	8′ 9″	29.	13′ 3″
15.	2′ 3″	30.	24′ 6″

OBJECTIVE: To learn how to multiply by percents.

INFORMATION:

To multiply by a percent, first you must change the percent to a decimal or common fraction, then multiply.

PROBLEM: 25% of 160 =

A. Change to a fraction: $25\% = \frac{25}{100} = \frac{1}{4}$

$\frac{1}{4} \times 160 = 40$ ANS.

B. Change to a decimal: $25\% = .25$

$.25 \times 160 = 40.00$ ANS.

↑ decimal point

In solving the problems you will encounter in your work, you will find that sometimes it is easier to convert the percent to a fraction, and sometimes to a decimal. You will naturally do whichever is simpler. If you are using a calculator, of course, you will convert to a decimal. But it is important to know and practice both ways.

(If you are using a calculator that has a special percent key, you will probably find that you can simply multiply by the percent itself and then press the [%] key in place of the [=] key.) Check this for yourself.

OBJECTIVE: To learn when and how to divide by percents.

INFORMATION:

To find a number when you know the **percent** of the number, you must divide by the percent. Proceed as in the problem below.

PROBLEM: 35% of a number is 7. Find the number.

35% X ? = 7

Change the percent to a decimal. 35% = .35 .35 X ? = 7

Use the decimal fraction (.35) as the divisor. Use the number (7) as the dividend. Then divide.

$$
\begin{array}{r}
20. \quad \text{ANS.} \\
35\overline{)700.} \\
70 \\
\hline
00
\end{array}
$$

Check the answer.

$$
\begin{array}{r}
20 \\
\times\ .35 \\
\hline
100 \\
60 \\
\hline
7.00
\end{array}
$$

↑
decimal point

In some cases it is easier to convert the percent to a common fraction rather than to a decimal before dividing. We will review division by fractions in Unit III.

(If you have a calculator with a % key, figure out how you would do the above problem on it.)

There will be a great many occasions when you will have to use percents. Learning to work with percents quickly and accurately will make your job easier. Follow the instructions on Information Sheets 11 and 12.

1. 5% of 275 =
2. 15% of 718 =
3. 25% of 15,894 =
4. 20% of 7,896 =
5. 6% of 15,275 =
6. $4\frac{1}{2}$% of 5,000 =
7. 7.5% of 4,270 =
8. $5\frac{1}{4}$% of 1,268 =
9. 10% of 15,789 =
10. 120% of 19,675 =

11. 6% of what number is 68?
12. 10% of what number is 27?
13. $12\frac{1}{2}$% of what number is 16?
14. 20% of what number is 49?
15. 77 is 40% of what number?
16. 126 is 8% of what number?

17. You borrow $2400, signing a promissory note to repay the money in a year at 8% interest. How much interest do you have to pay?

18. A contractor bought a truck listed at $9275, and was allowed a 7% discount from the list price. How much did the truck cost?

19. Twenty percent of a contractor's working capital was invested in a certain building project. If $13,500 was invested in it, what was the contractor's working capital?

20. A sales agent received a weekly salary of $185 and a 5% commission on sales. The agent's sales on Monday amounted to $510.50, on Tuesday, $740.15, on Wednesday, $315.80, on Thursday, $418.00, and on Saturday, $1024.50. What did the sales agent earn that week?

21. After working 12 days, a mason estimated that a job was about 40% complete. How much time would the whole job take at the same rate of speed?

ADD:

1. 2.70 + .063 + 79 + 8.1 + .8 =
2. 125.06 + 12 + .12 + 1.2 + 11.2 =
3. 7% + 12% + $5\frac{1}{2}$% + 40% + 110% =

SUBTRACT:

4. 275.26 − 188.674 =
5. 5.7382 − 2.687 =
6. 23% − $8\frac{1}{2}$% =

MULTIPLY:

7. 6.528 X 4.67 =
8. 510.8 X 6.72 =
9. $16\frac{2}{3}$% of 7125 =
10. 2.7 X 61.82 X 3 =
11. $6\frac{1}{2}$% of 428 =
12. $17\frac{1}{2}$ X $4.50 =
13. 120% of 345 =
14. 218 X .006 X 15 =
15. $3\frac{1}{2}$% of $489.00 =

DIVIDE:

16. 8.7 ÷ .03 =
17. .98 ÷ 4 =
18. 326.4 ÷ .025 =
19. 28 is 15% of what number ?
20. $7\frac{1}{2}$% ÷ 3 =
21. .8946 ÷ 2.4 =

CHANGE TO DECIMAL FRACTIONS:

22. $6\frac{1}{2}$%
23. $12\frac{1}{2}$%
24. 150%
25. $3\frac{3}{4}$%

CHANGE TO COMMON FRACTIONS:

26. 5%
27. $7\frac{1}{2}$%
28. $12\frac{1}{2}$%
29. 75%
30. 140%

CHANGE TO DECIMALS:

31. $\frac{7}{10}$
32. $\frac{2}{3}$
33. $\frac{5}{8}$
34. $\frac{3}{20}$
35. $\frac{1}{100}$

CHANGE TO FRACTIONS AND REDUCE TO LOWEST TERMS:

36. .25
37. .35
38. .2
39. .125
40. .99

FIND THE *DISCOUNT* ALLOWED ON EACH OF THE FOLLOWING:

41. 15% of $25
42. 33 1/3% of $67.17
43. 25% of $369.79
44. 50% of $1780
45. 2% of $563

COMPLETE THE TABLE BELOW

	Common Fraction Equivalent	Decimal Equivalent	Percent Equivalent
46.			25%
47.		.667	
48.			87½%
49.	1/20		
50.		.125	

Now go on to Test #1.

UNIT II – ROUNDING OFF NUMBERS

Why Round Off? **Information Sheet No. 1**

OBJECTIVE: To understand why rounding off is necessary.

INFORMATION:

Suppose you were interested in the number of miles per gallon that your car got. On a trip that covered 210 miles, your car used 8.7 gallons of gas. Dividing 210 by 8.7, you got a figure of 24.137931 mpg. Did your car actually go 24.137931 miles on each gallon?

Of course it didn't. Sometimes it did better, sometimes it did worse. Furthermore, that figure was based on 210 miles. Was it exactly 210 miles? It could have been a little more or a little less. And did you really use exactly 8.7 gallons? Maybe your tank was not absolutely full when you started to count the miles. Maybe the amount of gas replaced was not exactly 8.7 gallons.

Each figure used in calculating your average gas mileage was really only an *approximation.* Any measurement is only an approximation. Therefore an answer like 24.137931 – which *seems* to be very accurate – is *pretending* to an accuracy which it doesn't really have.

How then would you treat such a figure in real life? You would *round it off.* In this case you would round it off to the *nearest whole number,* and conclude that on your trip you got *about* 24 miles to the gallon.

Some figures need to be much more accurate than others. In scientific work, in trades like machine shop, drafting, industrial sheet metal, electronics production, and in some business situations, we might need highly accurate numbers. For other trades, and for everyday life, extreme accuracy is not usually needed. For example, a carpenter usually measures to the nearest sixteenth of an inch. A mason might measure to the nearest eighth of an inch. Each trade has its own need for accuracy.

There is another reason for rounding off numbers. Very often our calculators will produce numbers that are much more accurate (or that *pretend* to be more accurate) than we need. We get a string of digits, and we are not sure what to do with them all.

Suppose we divide the number 3 by the number 4. The calculator gives us 0.75, which is a reasonable figure to deal with in real life.

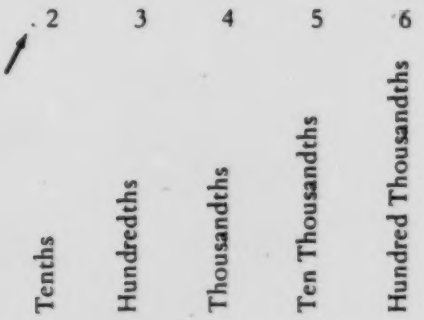
Suppose we divide the number 2 by the number 3. The answer is a decimal point followed by an infinite number of 6's. (0.666666666666666666 . ..) Of course we cannot use an infinite number of sixes. We will therefore *round off* the decimal. We might round it off to 0.7, or 0.67, or 0.667, etc., depending upon the situation.

Remember this: Every measurement, no matter how carefully made, is only an approximation. The "true" measurement might be a bit more or a bit less. When we multiply and divide such measurements, we often get answers with a lot of decimal places. It is only common sense to round off the answers so that they are realistic

OBJECTIVE: To learn to round off numbers.

INFORMATION:

Before we start rounding off numbers, let us review the names of the *decimal places* in any number.



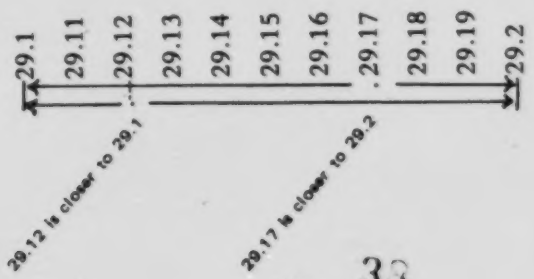
As we said before, very often in doing problems we end up with many more figures than we need. They are just excess baggage to carry around. We want to get rid of some of them – depending on the nature of our work – and give an answer that is practical for our purpose.

Look at the number 29.17

We will round it off to the *nearest tenth*. (There is a 1 in the tenths place.) What we are asking ourselves is, "Is the number 29.17 closer to 29.1 or to 29.2 ?" If you think a minute or two, you will see that the number 29.17 is closer to 29.2. Therefore, rounded off to the nearest tenth, 29.17 becomes 29.2.

On the other hand, look at the number 29.12

This number is closer to 29.1 than to 29.2. Therefore, rounded off to the nearest tenth, 29.12 is 29.1.



Rounding off is used more often with decimals, although it may be used with whole numbers also. There are several different systems for rounding off numbers. We will use the most common one.

Let us go back to 29.17, to be rounded off to the nearest tenth.

Look at the *digit to the right of the digit in the tenths' place* (7). If this number is *less than 5*, just drop it. If this number is *5 or more*, increase the number in the tenths' place by 1 and drop the number. Since 7 is greater than 5, we increase the 1 to 2 and drop the 7. Rounded off to the nearest tenth, then, 29.17 becomes

29.2.

Let us state the above rule in a general way, and then make it clearer by giving other examples.

To round off a number to a certain place:

1. Look at the digit to the right of that place.
2. If that digit is less than 5, drop it and any other digits farther to the right. Leave the rest of the number as it is.
3. If that digit is 5 or more, increase the digit in the required place by 1 and drop that digit and any other digits farther to the right.

Example A: Round off \$39.165 to the nearest cent.

Step I	\$39.165 ↑	Write the problem and note which place is to be kept.
Step II	\$39.16$\underline{5}$	Look at the digit to the right of that place. Underline it if you like. Since it is 5 (or larger),
Step III	\$39.17 (Answer)	Increase the digit in the required place by 1 and drop all the digits to the right of it.

Example B: Round off \$24.463 to the nearest cent.

Step I	\$24.463 ↑	Write the problem and note which place is to be kept.
Step II	\$24.46$\underline{3}$	Look at the digit to the right of that place. Underline it if you like. Since it is less than 5,
Step III	\$24.46 (Answer)	Leave the digit in the required place as it is and drop the digit to the right.

Example C: Round off 5.2351 to the nearest tenth.

Step I	5.2351 ↑	Write the problem. Note the place to be kept.
Step II	5.2351 ↑	Note the digit to the right. It is less than 5.
Step III	5.2 (Answer)	Drop it and the other digits to the right. Leave the digit in the required place as it is.

Example D: Round off 16.298 to the nearest hundredth.

Step I	16.298 ↑	Write the problem. Note the place to be kept.
Step II	16.298	Note the digit to the right. It is more than 5.
Step III	$16.\overset{1}{2}0$	In adding 1 to 9, we get 10. We put down the 0 and carry the 1 to the next place.
Step IV	16.30 (Answer)	Add the 1 to the 2.

Note that the number 16.30 is correct to the nearest *hundredth*. The number 16.3 is correct to the nearest *tenth*. In other words, 16.30 stands for a whole collection of numbers between 16.295 and 16.304, while 16.3 stands for a collection of numbers between 16.25 and 16.34.

In filling out your income tax return, you are permitted by the Internal Revenue Service to round off all your figures to the nearest whole dollar.

Example E: Round off $207.43 to the nearest whole dollar.

Step I	$207.43 ↑	Write the problem. Note the place to be kept.
Step II	$207.43	Note the digit to the right. It is less than 5.
Step III	$207	Leave the digit in the required place as it is and drop the digits to the right.

Example F: Round off $3199.56 to the nearest whole dollar.

Step I	$3199.56 ↑	Write the problem. Note the place to be kept.
Step II	$3199.56	Note the digit to the right. It is 5.
Step III	$\$31\overset{1}{9}0$	In adding 1 to the 9, we get 10. We put down the 0, and carry the 1 to the next place.
Step IV	$3200 (Answer)	Finish the problem by carrying as many times as necessary.

1. All measurements are _____.

2. Multiplying and dividing numbers often gives answers with _____.

3. If an answer has more numbers in it than are really accurate (or than we need), we get rid of the extra figures by _____.

4. A. Round off these numbers to the nearest tenth:

(1)	45.29	(6)	3.502
(2)	45.22	(7)	12.05
(3)	45.2299	(8)	12.0555
(4)	45.2987	(9)	326.18
(5)	3.68	(10)	620.549

B. Round off these numbers to the nearest hundredth:

(1)	34.376	(6)	69.75499
(2)	3.1416	(7)	69.75500
(3)	200.3921	(8)	101.219
(4)	13.493	(9)	28.0607
(5)	55.525	(10)	2615.005

C. Round off these amounts to the nearest cent:

(1)	$15.675	(6)	$4.9609
(2)	$23.028	(7)	$ .365
(3)	$224.993	(8)	$1.9723
(4)	$135.365	(9)	$4215.505
(5)	$2.1372	(10)	$6.3175

A. Round off these numbers to the nearest tenth:

(1)	15.732	(6)	62.604
(2)	15.756	(7)	59.01
(3)	21.93	(8)	136.97
(4)	21.95	(9)	90.85
(5)	21.99	(10)	100.05

B. Round off these amounts to the nearest cent:

(1)	$12.245	(6)	$16.6667
(2)	$122.295	(7)	$45.497
(3)	$3.0552	(8)	$34.9929
(4)	$10.1549	(9)	$34.995
(5)	$21.6333	(10)	$27.698

C. Round off these amounts to the nearest whole dollar:

(1)	$20.23	(6)	$21.98
(2)	$100.50	(7)	$360.95
(3)	$26.72	(8)	$369.95
(4)	$29.72	(9)	$399.95
(5)	$4325.09	(10)	$ .75

D. Round off to the nearest tenth of a foot:

(1)	16.429′	(6)	15.95′
(2)	33.088′	(7)	7.049′
(3)	10.292′	(8)	12.009′
(4)	10.004′	(9)	.4782′
(5)	6.93′	(10)	10.6504′

UNIT III – FRACTIONS

Addition of Fractions **Information Sheet No. 1**

OBJECTIVE: To learn the proper way of adding fractions.

INFORMATION:

You know that you cannot add things that are not alike. How would you add 10 bricks, 12 cinder blocks, and 3 bags of cement? You simply cannot combine these into any one figure.

Similarly, you cannot add fractions unless they are the same kind of fraction. You can add $\frac{1}{8}$, $\frac{3}{8}$ and $\frac{7}{8}$ (the answer is $\frac{11}{8}$ or $1\frac{3}{8}$). But you cannot add $\frac{1}{2}$, $\frac{2}{3}$, and $\frac{3}{8}$. However, in the case of fractions, it is possible to change the form of each one (without changing its value) so that they are all the same kind of fraction, and then they can be added.

To do this, you must first find the **lowest common denominator** (the denominator is the bottom figure of the fraction.) This lowest common denominator is the smallest number that can be divided evenly by all the denominators. The denominators of $\frac{1}{2}$ and $\frac{3}{8}$ give us no trouble. Eight is a common denominator of both. But to get a common denominator with $\frac{2}{3}$, we multiply the denominators 8 x 3, giving us 24, which is evenly divisible by 2, 3, and 8.

PROBLEM: Add $1\frac{1}{2}$, $\frac{2}{3}$, $7\frac{3}{8}$.

1. List all the numbers to be added clearly and neatly. If you cannot list the numbers in straight columns, draw a straight line between them. Do not crowd the numbers. Leave a space between the column of whole numbers and the column of fractions.

$$\begin{array}{r} 1\ \frac{1}{2} \\ \frac{2}{3} \\ 7\ \frac{3}{8} \\ \hline \end{array}$$

2. Write your common denominator (24) to the right of the fraction column under a line. Do not list it opposite each fraction you are going to change.

$$\begin{array}{r} 1\ \frac{1}{2} \\ \frac{2}{3} \\ 7\ \frac{3}{8} \\ \hline \end{array}$$

(common denominator) 24

3. Change each fraction into an equal fraction having 24 as a denominator. In this case, $\frac{1}{2} = \frac{12}{24}$, $\frac{2}{3} = \frac{16}{24}$, $\frac{3}{8} = \frac{9}{24}$. List the top number only of the common fractions in a column alongside the original fractions.

$$\begin{array}{rrcr} & & & \downarrow \\ 1 & \frac{1}{2} & = & 12 \\ & \frac{2}{3} & = & 16 \\ 7 & \frac{3}{8} & = & 9 \\ \hline & & & \frac{}{24} \end{array}$$

4. Add the top numbers (numerators) of the common fractions and place the total above the common denominator. You now have an improper fraction $\frac{37}{24}$ which you must reduce to $1\frac{13}{24}$.

$$\begin{array}{rrcr} & & & \\ 1 & \frac{1}{2} & = & 12 \\ & \frac{2}{3} & = & 16 \\ 7 & \frac{3}{8} & = & 9 \\ \hline & & & \frac{37}{24} = 1\frac{13}{24} \end{array}$$

5. Cross out the "1" and carry to the whole numbers column. Add the whole numbers. You get a total of 9.

Below the problem write the complete answer clearly.

$$\begin{array}{rrcr} & & & \\ 1^{1} & \frac{1}{2} & = & 12 \\ & \frac{2}{3} & = & 16 \\ 7 & \frac{3}{8} & = & 9 \\ \hline 9 & & & \frac{37}{24} = 1\frac{13}{24} \end{array}$$

ANS. $9\frac{13}{24}$

You cannot learn to add fractions quickly and accurately unless you practice. The following assignment sheets provide the practice problems to help you learn to add fractions.

List the numbers to be added clearly, neatly, and correctly. Check to be sure that the numbers are listed properly. Do all of your work on the work sheet. Work carefully and accurately. Follow Information Sheet No 1.

ADD:

1. $2\frac{1}{2} + \frac{3}{4} + 5\frac{1}{8} =$
2. $\frac{1}{4} + 11\frac{1}{2} + 3\frac{5}{8} =$
3. $2\frac{2}{3} + 18\frac{1}{2} + \frac{5}{6} =$
4. $\frac{3}{4} + \frac{1}{6} + \frac{2}{3} =$
5. $9\frac{1}{2} + 3\frac{7}{8} + 4\frac{1}{4} =$
6. $17\frac{1}{2} + 11\frac{3}{4} + 21\frac{7}{8} =$
7. $\frac{5}{8} + \frac{3}{4} + \frac{9}{16} =$
8. $49\frac{3}{8} + 26\frac{1}{4} + 67\frac{7}{16} =$
9. $37\frac{3}{4} + 75\frac{7}{8} + 9\frac{3}{16} =$
10. $\frac{1}{2} + 127\frac{3}{4} + 7\frac{7}{8} =$
11. $41\frac{1}{2} + 2\frac{7}{8} + 3\frac{3}{4} + 89\frac{9}{16} =$
12. $22\frac{2}{5} + 19\frac{3}{5} + 2 + 101\frac{1}{10} =$
13. $14\frac{3}{8} + 3\frac{3}{4} + 6\frac{7}{8} + 9\frac{1}{2} =$
14. $12\frac{1}{2} + 13\frac{1}{4} + 14\frac{5}{8} + 16\frac{1}{16} =$
15. $66\frac{2}{3} + 33\frac{1}{3} + 9\frac{1}{6} + 6 + 10\frac{2}{3} =$

REVIEW PROBLEMS:

16. How much would it cost to build a wall if you paid $375.50 for brick, $78.75 for concrete, $13.95 for sand, $21.25 for cement, and $195.45 for labor?

17. What is the total cost of the following equipment? 1 mixer $602.50, 1 mixing box $49.75, 6 mortar pans @ $10.50 each, 5 shovels @ $8.50 each, 1 mortar hoe $9.25.

18. How much is the total payroll if you paid $1,475.50 to bricklayers, $1,389.49 to carpenters, $1,187.28 to laborers, $169.75 to truck drivers, $642.75 to engineers, and $233.25 to timekeepers?

19. How much would a kit of tools cost if you spend $8.50 for a brick trowel, $3.75 for a pointing trowel, $2.15 for a jointer, $3.69 for a rule, $5.79 for a brick hammer, $4.75 for a brick set, $19.75 for a 4' level, $10.25 for a 2' level, and $9.50 for a tool bag?

20. How much is the total overhead if you paid $559.65 for compensation insurance, $365.00 for office rent, $47.59 for electricity, $45.50 for advertising, $315.50 for clerks, $27.75 for phone service, and $225.00 for legal fees?

ADD:

1. $1\frac{1}{2} + 15\frac{5}{8} + 86 + 23\frac{7}{8}$
2. $101\frac{1}{4} + 2\frac{3}{4} + 7\frac{7}{8} + 46\frac{3}{4}$
3. $\frac{3}{4} + \frac{1}{2} + \frac{7}{8} + \frac{1}{4}$
4. $14\frac{3}{4} + \frac{7}{8} + 21\frac{5}{8} + 104\frac{1}{2}$
5. $21\frac{1}{2} + 32\frac{3}{4} + 3\frac{7}{8} + 19\frac{1}{4}$
6. $196\frac{3}{4} + 2\frac{1}{2} + 48\frac{5}{8} + 67\frac{3}{8}$
7. $1{,}840 + 123\frac{9}{16} + 7\frac{1}{2} + 86\frac{3}{4}$
8. $18\frac{1}{4} + 96\frac{3}{4} + 1\frac{7}{8} + 206\frac{1}{2}$
9. $2\frac{1}{2} + 4\frac{3}{4} + 6\frac{7}{8} + 8\frac{3}{8} + 10\frac{1}{2}$
10. $\frac{1}{2} + \frac{3}{4} + \frac{5}{8} + \frac{13}{16}$

11. How many cubic yards of concrete are needed for a job that requires $4\frac{1}{2}$ cu. yds. for column footings, $6\frac{3}{4}$ cu. yds. for step footings, $23\frac{5}{8}$ cu. yds. for foundation footings, $2\frac{2}{3}$ cu. yds. for areaways, and $7\frac{1}{2}$ cu. yds. for sidewalks?

12. How many cubic yards of sand are needed for a job that requires $12\frac{1}{4}$ cu. yds. for mortar for brick, $16\frac{3}{4}$ cu. yds. for mortar for block, $3\frac{1}{2}$ cu. yds. for concrete, $9\frac{2}{3}$ cu. yds. for plaster?

13. A trucker hauled $12\frac{1}{3}$ cu. yds. of sand, $17\frac{3}{4}$ cu. yds. of cinders, $9\frac{1}{2}$ cu. yds. of gravel, $6\frac{1}{4}$ cu. yds. of crushed stone, and $14\frac{2}{3}$ cu. yds. of fill. How many cu. yds. did the trucker haul altogether?

ADD:

14. $1\frac{1}{2} + 32\frac{7}{8} + 29\frac{3}{4} + 87\frac{1}{8}$
15. $264\frac{3}{4} + 24\frac{5}{8} + 5\frac{5}{8} + 38\frac{1}{2}$
16. $56\frac{7}{8} + 4\frac{3}{4} + 12\frac{1}{2} + 85\frac{5}{8}$
17. $16\frac{1}{2} + 35\frac{3}{4} + 3\frac{3}{4} + 7$
18. $1{,}255\frac{3}{4} + 1\frac{9}{16} + 11\frac{15}{16}$

REVIEW PROBLEMS:

19. A bricklayer spent $15.25 for overalls, $12.75 for a jumper, $19.95 for shoes, $7.39 for a shirt, and $3.99 for a cap. How much did these work clothes cost?

20. A contractor paid $10.30 per hr. for bricklayers, $7.45 per hr. for laborers, $9.85 per hr. for carpenters, $10.10 per hr. for waterproofers, $9.05 per hr. for roofers, and $10.75 per hr. for ironworkers, and $7.95 per hr. for tapers. How much was the total hourly cost for 1 worker from each trade?

OBJECTIVE: To learn to add fractions on the calculator.

INFORMATION:

As we said before, in order to add fractions on a calculator, you must *change them to decimals first.*

If necessary, review the fraction/decimal equivalents on pages 21 and 23. You should have no problem adding the fractions whose equivalents you know.

Example:

Add: $3\frac{1}{2} + 2\frac{5}{8} + 10\frac{3}{4}$

Enter: 3.5, +, 2.625, +, 10.75, = Display: 16.875 (Ans.)

If you do not know the decimal equivalent of a fraction, either look it up in a table or divide it out on your calculator. Then you may either write the decimal down on scrap paper or put it into your calculator's "memory," if it has one. You will use the [M+] (add to memory) key to put it in, and the [MR] (memory recall) key to bring it back when you need it.

For example, if you had to add $2\frac{3}{16}$ to another number, and you did not know the decimal equivalent of $\frac{3}{16}$, then, before you started the problem, you would divide 3 by 16 and put the result into memory. You would add into memory any other such fractions you did not know the equivalents of. Then you would work the rest of the problem and simply add the contents of the memory to the rest of the problem.

You realize, of course, that $2\frac{3}{16}$ means 2 *plus* $\frac{3}{16}$. So *adding* the decimal that is in memory to the 2 will give you exactly the same result as if you had remembered the decimal equivalent in the first place and entered it.

Caution: Before putting anything into memory, for a *new problem,* press the [MC] (memory clear) key. (This can be done at any time during a problem without disturbing the rest of the problem).

Example:

ADD: $2\frac{3}{16} + 5\frac{7}{8} + 10\frac{5}{16}$

Press: [MC]

Enter: 3, ÷, 16, =	Display:	0.1875
Press: [M+]	Display:	0.1875m*
Enter: 5, ÷, 16, =	Display:	0.3125m*
Press: [M+]	Display:	0.3125 m*
Enter: 2, +, 5.875, +, 10, +, [MR] =	Display:	18.375m* (Ans.)

* Different calculators have different ways of showing that there is a number in the memory.

1. Follow the instructions given on the previous page for adding $2\frac{3}{16} + 5\frac{7}{8} + 10\frac{5}{16}$, and do the problem yourself on a calculator.

2. Add the following, using the same procedure.

$$3\frac{1}{12} + 4\frac{3}{4} + 2\frac{7}{12} + 1\frac{7}{16}$$

Did you get 11.854 . . .? Round this answer off to the nearest tenth.

3. Now go back over the last two assignment sheets and add all the fraction problems on the calculator.

Note that, in a few instances, the decimal answer will not quite correspond to your answer with fractions. The reason for this is that the decimal equivalents of some fractions, like thirds or twelfths, are only *approximations,* not exact numbers. For example, we have said that

$$\frac{1}{3} = .333 \text{ and } \frac{5}{12} = .417$$

In reality,

$\frac{1}{3}$ = .333333333 . . . . (and on forever)

and $\frac{5}{12}$ = .4166666666 . . . . (and on forever)

We could make the answer come out extremely close in such cases by using a longer decimal, but for our purposes this is not necessary.

OBJECTIVE: To learn how to add dimensions easily and accurately.

INFORMATION:

In the previous lessons you learned to add whole numbers and fractions. This was to prepare you to add dimensions. By following the information given below, you will learn to add dimensions easily and accurately.

PROBLEM: Add $7' \ 10\frac{3}{4}'' + 3' \ \frac{1}{2}'' + 9\frac{3}{8}''$

1. List the dimensions to be added clearly and neatly. Each dimension must be listed in the 3 columns, feet, inches, and fractions of an inch.

Feet	Inches	Fractions of an Inch
7	10	$\frac{3}{4}$
3		$\frac{1}{2}$
	9	$\frac{3}{8}$

2. Find the common denominator. In the case of fractions of an inch, the lowest common denominator will always be the largest denominator (in this case, 8). Change the fractions to common fractions, then add the top numbers (numerators). You get $\frac{13}{8}$ inches, which you reduce to $1\frac{5}{8}$ inches.

7	10	$\frac{3}{4} = 6$
3		$\frac{1}{2} = 4$
	9	$\frac{3}{8} = 3$
		$\frac{13}{8} = 1\frac{5}{8}$

3. Cross out the 1 inch and carry to the "inches" column. Add the inches column, which gives you 20 inches. You now reduce the 20 inches to feet and inches by dividing 20 inches by 12 inches (which equals 1 foot). This gives you 1 foot and 8 inches.

7	10	$\frac{3}{4} = 6$
3		$\frac{1}{2} = 4$
	9_1	$\frac{3}{8} = 3$
	20	$\frac{13}{8} = 1\frac{5}{8}$
	↓	
	1' 8"	

4. Carry the 1 foot to the "feet" column and add up the number of feet. You get 11 feet for the total.

   Now below the problem write the answer clearly and place the foot and inch symbols in their proper place.

7	10	$\frac{3}{4} = 6$
3		$\frac{1}{2} = 4$
1	9_1	$\frac{3}{8} = 3$
11	20	$\frac{13}{8} = 1\frac{5}{8}$

1′ 8″

ANS. $11' \; 8\frac{5}{8}''$

List the dimensions to be added clearly and neatly. Make certain that the feet, inches and fractions of an inch are placed in the proper columns. Follow the instructions on Information Sheet No. 3 and solve the following problems.

1. What is the perimeter of a building whose dimensions are 29′ $8\frac{1}{2}$″ , 18′ 6″ , 29′ $8\frac{1}{2}$″ , 18′ 6″ ?

2. The sidewalks around a building measure 21′ $6\frac{1}{2}$″, 18′ 10″, 12′ $\frac{3}{4}$″, 43′ $7\frac{1}{4}$″ and 9′ 5″. What is their total length?

3. An irregularly shaped patio has sides measuring 18′ $3\frac{1}{2}$″, 20′ $\frac{3}{4}$″, 24′ 6″, 21′ $2\frac{1}{4}$″, and 17′ $11\frac{1}{4}$″. What is the distance around it?

4. A builder had to excavate $4\frac{1}{2}$ cu. yds. for column footings, $146\frac{2}{3}$ cu. yds. for the basement, $18\frac{1}{2}$ cu. yds. for the steps, $7\frac{3}{4}$ cu. yds. for areaways, $43\frac{1}{4}$ cu. yds. for the septic tank, $8\frac{1}{3}$ cu. yds. for sidewalks and $1\frac{3}{4}$ cu. yds. for the fireplace footing. How many cu. yds. did the builder have to excavate?

5. A mason worked $16\frac{1}{2}$ hours laying brick, $12\frac{3}{4}$ hours laying blocks, $8\frac{1}{3}$ hours on a sidewalk, $19\frac{1}{4}$ hours plastering, $5\frac{2}{3}$ hours putting in a tile drain, $7\frac{1}{2}$ hours pouring concrete, and $3\frac{3}{4}$ hours washing down the brickwork. How many hours did the mason work?

OBJECTIVE: To learn to add dimensions on the calculator.

INFORMATION:

In adding dimensions, you will be dealing with feet, inches, and fractions of an inch. The easiest way to add them on the calculator is to change them all to inches and decimal parts of an inch. You will put the figures into the memory, separately if necessary.

The answer you get will be in inches and decimal parts of an inch. Then you will simply divide that number by 12 to get the answer in feet and decimal parts of a foot.*

Follow this example with your calculator:

ADD: $16' \; 3\frac{1}{2}" + 32' \; 5\frac{3}{4}" + 11\frac{5}{8}"$

Press:	[MC]	
Enter:	16, x, 12, +, 3.5, =	Display: 195.5
Press:	[M+]	Display: 195.5m
Enter:	32, x, 12, +, 5.75, =	Display: 389.75m
Press:	[M+]	
Enter:	11.625	Display: 11.625m
Press:	[M+]	
Press:	[MR]	Display: 596.875m (Answer in inches)
Enter:	÷, 12, =	Display: 49.7395 . . .m (Answer in feet)

For now you will round off your answer to 3 decimal places.

49.7395 = 49.740 (rounded off)

*It is also possible to change all numbers to feet and decimal fractions of a foot as you go along by dividing the inches (and decimal parts of an inch) by 12 each time.

ADD on a calculator. Express your answer in feet, correct to 3 decimal places if the answer does not come out even.

1. $42' \; 1\frac{1}{2}'' + 99' \; 6'' + 7' \; 3\frac{1}{8}'' =$
2. $6\frac{7}{8}'' + 1{,}000' \; 9'' + 9' \; 10\frac{3}{4}'' =$
3. $15' \; \frac{3}{4}'' + 11' \; 8\frac{1}{8}'' + 195' \; 6'' =$
4. $20' \; 5'' + 2{,}329' + 8\frac{1}{2}'' + 21' \; 7\frac{7}{8}'' =$
5. $29' \; 8\frac{1}{2}'' + 375' \; \frac{3}{8}'' + 4' \; 11\frac{3}{4}'' + 10'' =$
6. $7' \; \frac{1}{2}'' + 12' \; 8'' + 4' \; 6\frac{1}{8}'' + 33' \; 6\frac{1}{4}'' =$
7. $14' + 112' \; 6'' + 8' \; 9\frac{3}{8}'' + 8\frac{3}{4}'' =$
8. $9' \; 11\frac{5}{8}'' + 6\frac{3}{4}'' + 135' \; 2\frac{5}{16}'' + 78' \; 7'' =$
9. $102' \; 11\frac{9}{16}'' + 8\frac{1}{2}'' + 12' \; 3'' + 7' \; \frac{3}{4}'' + 4' \; 5'' =$
10. $8' \; \frac{1}{2}'' + 7' \; \frac{3}{4}'' + 201' \; 5\frac{7}{16}'' + 11'' + 9' \; \frac{5}{8}'' =$

OBJECTIVE: You will learn to convert fractional and decimal parts of a foot into inches.

INFORMATION:

In your last assignment, you got answers in feet and decimal parts of a foot. Usually you will want your answer in feet *and inches*. It is very simple to get inches from any particular fractional or decimal part of a foot. You simply multiply it by 12.

For example:

$\frac{3}{4}' = \frac{3}{\cancel{4}_1} \times \frac{\cancel{12}^3}{1} = 9$ inches

$6\frac{3}{4}' = 6'\ 9''$

$\frac{2}{3}' = \frac{2}{\cancel{3}_1} \times \frac{\cancel{12}^4}{1} = 8$ inches

(Multiplication of a fraction by a whole number is discussed on page 62.)

$17\frac{2}{3}' = 17'\ 8''$

$.625' = .625 \times 12 = 7.5$ inches

$14.625' = 14'\ 7.5''$

$32.594' = 32' + (.594 \times 12)'' = 32'\ 7.128''$

Optional

You can carry this a step farther if you need to. The above answer, 32' 7.128", can be changed to feet, inches, and *eighths of an inch* (or even 16ths of an inch). We multiply the decimal part by 8 (or 16) to get the number of eighths (or sixteenths).

$.128 \times 8 = 1.024$ (slightly over $\frac{1}{8}$ inch)

$.128 \times 16 = 2.048$ (slightly over $\frac{2}{16}$ inches)

So the above answer would be

$32'\ 7\frac{1}{8}''$ or $32'\ 7\frac{2}{16}''$

How do you think you would convert the decimal part of an inch to *quarters of an inch?*

1. Express these fractions of a foot in inches, either from memory or as shown in the previous information sheet.

   (a) $\frac{1}{3}' =$

   (b) $\frac{1}{4}' =$

   (c) $\frac{1}{10}' =$

   (d) $\frac{1}{12}' =$

   (e) $\frac{7}{12}' =$

   (f) $\frac{1}{2}' =$

2. Express these decimal parts of a foot in inches. (If you recognize any, do not bother to multiply out.)

   (a) $.5' =$
   (b) $.375' =$
   (c) $.1' =$
   (d) $.245' =$
   (e) $.333' =$
   (f) $.667' =$

3. Express the following in feet and inches. Do these mentally whenever you can.

   (a) $16.25' =$
   (b) $8.75' =$
   (c) $13.125' =$
   (d) $201.25' =$
   (e) $3.167' =$
   (f) $12.795' =$

4. Go back to Assignment Sheet No. 5 and give all your answers in feet and inches. Round off the inches figure to the *nearest whole inch.*

5. Add the following and give your answer in feet and inches, correct to the nearest whole inch.

(a) $47' \; 8\frac{3}{4}'' + 7' \; \frac{1}{2}'' + 137' \; 6'' + 6' \; 6\frac{9}{16}''$

(b) $6' \; \frac{1}{2}'' + 4\frac{3}{4}'' + 7' \; 11\frac{1}{4}'' + 5' \; 5''$

(c) $5' \; 8\frac{3}{4}'' + 129' \; 3'' + 15' \; 11\frac{5}{8}'' + 11\frac{13}{16}''$

(d) $625' + 2' \; 8\frac{3}{4}'' + 11\frac{1}{2}'' + 78' \; 9''$

(e) $16' \; 7\frac{1}{2}'' + 139' \; 10\frac{3}{4}'' + 278' \; 9\frac{7}{8}''$

ADD: (Give your answer correct to the nearest whole inch.)

1. $8\frac{1}{2}" + 10' 5\frac{3}{4}" + 72' 11\frac{1}{8}" =$
2. $238' 4\frac{3}{4}" + 7' \frac{3}{8}" + 21' 9\frac{1}{4}" =$
3. $1{,}101' 4\frac{1}{4}" + 7\frac{7}{16}" + 247' =$
4. $8" + 1{,}042' 6\frac{1}{4}" + 198' \frac{5}{8}" =$
5. $141' 2\frac{3}{4}" + 9\frac{9}{16}" + 21' + 23' 11\frac{7}{8}" =$
6. $7' 11" + 100' + 42' 8\frac{1}{4}" + 6\frac{7}{8}" =$
7. $627' 8\frac{5}{8}" + 72' \frac{1}{2}" + 9\frac{1}{4}" + 17' \frac{7}{16}" =$
8. $569' \frac{3}{4}" + 79' 6\frac{3}{8}" + 125' \frac{1}{4}" + 7" =$
9. $6' 8\frac{3}{4}" + 257' + 32' \frac{13}{16}" + 4' 11\frac{7}{8}" + 11\frac{9}{16}" =$
10. $11" + 2' \frac{5}{8}" + 826' + 9' \frac{9}{16}" + 42' 11\frac{1}{2}" =$
11. $16' 7\frac{3}{4}" + 101' \frac{9}{16}" + 1' 11\frac{1}{2}" + 73' 3\frac{3}{4}" + 8\frac{5}{8}" =$
12. $112' \frac{1}{4}" + 7' 6\frac{7}{8}" + 122' \frac{7}{16}" + 33' 9\frac{3}{4}" =$
13. $8\frac{5}{8}" + 100' \frac{1}{2}" + 7' 6\frac{3}{4}" + 1{,}018' 5\frac{7}{16}" + 7' \frac{3}{8}" =$
14. $12' 11\frac{5}{8}" + 6\frac{3}{4}" + 101' \frac{9}{16}" + 3' 3" + 17' \frac{7}{8}" =$
15. $14' 10\frac{3}{4}" + 6' \frac{7}{8}" + 111' + 7' \frac{15}{16}" + 18' 6\frac{5}{8}" =$
16. $100' \frac{3}{4}" + 5' \frac{9}{16}" + 4' 9\frac{3}{4}" + 7\frac{3}{8}" + 6' 1\frac{3}{4}" =$
17. $203' 5\frac{3}{4}" + 23' \frac{9}{16}" + 1' 3\frac{3}{8}" + 15' 1\frac{11}{16}" + 3' \frac{5}{8}" =$

18. A builder installed 87′ 6″ of sidewalk on Monday, 136′ $8\frac{1}{2}$″ of sidewalk on Tuesday, 119′ 7″ of sidewalk on Wednesday, 93′ 2″ of sidewalk on Thursday, 158′ $10\frac{3}{4}$″ of sidewalk on Friday. How many feet of sidewalk did the builder install?

REVIEW PROBLEMS:

19. A builder paid $879.75 for face brick, $426.95 for common brick, $179.38 for mortar cement, $88.57 for sand, $284.26 for concrete, $199.52 for blocks and $57.49 for gravel. How much did the builder pay for the material?

20. A builder paid $4,753.69 for material, $1,926.87 for labor, $789.14 for overhead, $43.75 for advertising, $243.28 for trucking and $478.65 for scaffold rental. How much did the job cost?

OBJECTIVE: To learn the correct way of subtracting dimensions.

INFORMATION:

When you subtract dimensions, you must always start by subtracting the fractions of an inch first, next you subtract the inches, and last the feet.

List all numbers clearly and in neat columns. Cross out each number from which you borrow and write the correct number above it so that you do not make a mistake.

Do not crowd the figures. You will find it is much easier to work out a problem which is neatly and clearly written, with the numbers widely spaced.

PROBLEM: Subtract 127′ $10\frac{5}{8}$″ from 168′ $7\frac{5}{16}$″

1. Change the fractions of an inch so they both have the same common denominator.

$$\begin{array}{rrl} 168 & 7 & \frac{5}{16} = \frac{5}{16} \\ -127 & 10 & \frac{5}{8} = \frac{10}{16} \end{array}$$

2. Since you cannot subtract $\frac{10}{16}$″ from $\frac{5}{16}$″, you must borrow 1″ from the 7″. Cross out the 7 and write 6 above it. 1″ equals $\frac{16}{16}$″. You add $\frac{16}{16}$″ to the $\frac{5}{16}$″ = $\frac{21}{16}$″. Cross out the $\frac{5}{16}$″ and write $\frac{21}{16}$″ next to it. Then subtract $\frac{10}{16}$″ from $\frac{21}{16}$, giving $\frac{11}{16}$″. Write $\frac{11}{16}$ below the line.

$$\begin{array}{rrl} 168 & 7^{6} & \frac{5}{16} = \frac{5}{16} = \frac{21}{16} \\ 127 & 10 & \frac{5}{8} = \frac{10}{16} = \frac{10}{16} \end{array}$$

$\frac{11}{16}$

3. You cannot subtract 10″ from 6″ so you must borrow 1′ from 168′. Cross out the 8 and write 7 above it. 1′ = 12″. Add 12″ to 6″ = 18″. Cross out the 6 and write 18 above it. 18″ – 10″ = 8.

Write 8 below the line.

$$\begin{array}{rrl} 168 & 7\ 7^{\not 6\,18} & \frac{5}{16} = \frac{5}{16} = \frac{21}{16} \\ 127 & 10 & \frac{5}{8} = \frac{10}{16} = \frac{10}{16} \end{array}$$

8 $\frac{11}{16}$

4. Subtract 127′ from 167, giving 40. Write 40 below the line.

5. Write out the answer clearly with the foot and inch symbols in their proper places.

$$\begin{array}{lll} 16\cancel{8}^{7} & 7\cancel{0}^{18} & \frac{5}{16} = \frac{5}{16} = \frac{21}{16} \\ 127 & 10 & \frac{5}{8} = \frac{10}{16} = \frac{10}{16} \\ \hline 40 & 8 & \frac{11}{16} \end{array}$$

ANS. $40' \; 8\frac{11}{16}''$

SUBTRACT:

1. $6\frac{1}{2}'' - 3\frac{3}{4}'' =$
2. $1' 6'' - 8\frac{3}{8}'' =$
3. $7'' - 4\frac{1}{8}'' =$
4. $9\frac{1}{4}'' - 3\frac{5}{8}'' =$
5. $\frac{7}{8}'' - \frac{5}{16}'' =$
6. $1' \frac{5}{8}'' - 7\frac{1}{4}'' =$
7. $8\frac{1}{2}'' - 5\frac{3}{4}'' =$
8. $6\frac{7}{8}'' - 3'' =$
9. $2' 4\frac{1}{2}'' - 1' 9\frac{7}{8}'' =$
10. $1' 2'' - 6\frac{5}{8}'' =$
11. $2' - 1' 4\frac{3}{8}'' =$
12. $2' 5'' - 2' \frac{1}{4}'' =$
13. $11\frac{3}{4}'' - 5\frac{3}{8}'' =$
14. $1' \frac{5}{8}'' - 7'' =$
15. $2' - 1' 4'' =$

Subtraction of Dimensions on the Calculator **Information Sheet No. 7**

OBJECTIVE: To know how to use the calculator to subtract dimensions.

INFORMATION:

Most subtraction problems with fractional dimensions are more easily done with pencil and paper then on a calculator. In case you prefer to do them on a calculator, this lesson will show you one way of doing them.

The memory on a calculator can be *subtracted from* as well as added to. Most calculators have a [M–] key for that purpose.

Suppose you had the following problem to solve on your calculator:

$$161' \; 4\tfrac{1}{2}'' - 59' \; 6\tfrac{3}{16}''$$

Just as in addition, you will change each dimension to inches or decimal parts of an inch. First put into memory the separate parts of the *original* measurement. Then *subtract* from memory the separate parts of the measurement that is to be subtracted.

Your answer will be in inches and decimal parts of an inch. Divide by 12 to get feet and decimal parts of a foot. Round this off to 3 decimal places if necessary, then change the decimal portion to inches by multiplying by 12. Express your answer correct to the nearest inch.

Optional. You may, if you prefer, express your answer correct to the nearest eighth of an inch. (See page 50.)

Example:

Subtract $161' \; 4\tfrac{1}{2}'' - 59' \; 6\tfrac{3}{16}''$

(We will assume that you do not know the value of 3/16")

Press:	[MC]		
Enter:	161, x, 12, +, 4.5	Display:	1936.5
Press:	[M+]	Display:	1936.5m
Enter:	59, x, 12, =	Display:	708.m
Press:	[M–]		

Enter: 6 — Display: 6.m

Press: M–

Enter: 3, ÷ , 16, = — Display: 0.1875m

Press: M–

Press: MR — Display: 1222.3125m (Ans. in inches)

Enter: ÷, 12, = — Display: 101.859375m (Ans. in ft.)

Enter: .859*, x, 12, = — Display: 10.308m (Inches)

Answer: 101′ 10″

Optional:

Enter: .308, x, 8, = — Display: 2.464m (Eighths)

Answer: 101′ $10\frac{1}{4}$″ ($\frac{2}{8} = \frac{1}{4}$)

*To save the trouble of jotting down the .859, it is possible to subtract out the 101 from the 101.859375. That leaves the decimal portion alone on the display, ready to be multiplied by 12. Of course you must be sure not to lose your answer in the process!

SUBTRACT:

Work these problems either as fractions on paper or as decimals on the calculator. If on the calculator, give your answer correct to the nearest inch (or fraction, if you prefer).

1. $201' \; 9\frac{3}{4}'' - 102' \; 5\frac{3}{8}'' =$
2. $1{,}987' \; 2\frac{1}{4}'' - 1{,}698' \; 6\frac{5}{8}'' =$
3. $583' \; \frac{7}{8}'' - 327' \; 4\frac{13}{16}'' =$
4. $246' \; 3\frac{3}{8}'' - 175' \; \frac{3}{4}'' =$
5. $10{,}846' \; 5\frac{3}{4}'' - 2{,}679' \; 8\frac{3}{4}'' =$
6. $791' - 425' \; 5\frac{9}{16}'' =$
7. $155' \; \frac{1}{2}'' - 97' \; 5\frac{3}{8}'' =$
8. $369' \; 3\frac{5}{8}'' - 135' \; 7\frac{1}{8}'' =$
9. $263' \; 10\frac{11}{16}'' - 204' \; 8\frac{3}{4}'' =$
10. [illegible]$' - 279' \; 5\frac{3}{4}'' =$
11. $156' \; 9\frac{3}{8}'' - 102' \; 11'' =$
12. $123' \; 4\frac{5}{8}'' - 121' \; \frac{7}{8}'' =$
13. $847' \; 10\frac{3}{4}'' - 637' \; 7\frac{11}{16}'' =$
14. $707' \; 9'' - 548' \; \frac{3}{16}'' =$
15. $154' - 79' \; \frac{3}{8}'' =$
16. $683' \; 5\frac{5}{8}'' - 479' \; 8\frac{7}{8}'' =$
17. $179' \; \frac{3}{4}'' - 123' \; 5\frac{3}{8}'' =$
18. $248' \; 2\frac{9}{16}'' - 147' \; 6'' =$
19. $671' \; 6\frac{1}{4}'' - 437' \; \frac{3}{4}'' =$
20. $1{,}367' \; \frac{1}{2}'' - 1{,}186' \; 3\frac{3}{4}'' =$

(If you use a calculator, give your answer correct to the nearest whole inch.)

ADD:

1. $199' 11\frac{7}{8}" + 16' \frac{1}{2}" + 101' 9\frac{3}{4}"$
2. $122' \frac{1}{2}" + 71' 9\frac{3}{4}" + 8' 11\frac{7}{8}"$
3. $5' 6\frac{3}{4}" + 91' \frac{7}{8}" + 15' 11\frac{1}{2}"$
4. $6\frac{7}{8}" + 100' \frac{3}{4}" + 7' 11\frac{1}{2}"$
5. $41' \frac{3}{4}" + 9\frac{9}{16}" + 121' 2\frac{1}{2}" + 23' 11\frac{7}{8}"$

SUBTRACT:

6. $175' \frac{3}{8}" - 88' 6\frac{1}{2}" =$
7. $1{,}895' 9\frac{3}{8} - 1{,}599' 10\frac{3}{4}" =$
8. $225' 8" - 220' 9\frac{7}{8}" =$
9. $115' 3\frac{3}{8}" - 111' 7\frac{1}{2}" =$
10. $1{,}435' \frac{1}{2}" - 396' 10\frac{5}{8}" =$
11. $69' 3\frac{1}{4}" - 22' 8\frac{5}{8}" =$
12. $4{,}270' - 1{,}485' 6\frac{5}{8}" =$
13. $2{,}798' 6" - 1{,}797' 7\frac{1}{2}" =$
14. $2{,}059' 11\frac{13}{16}" - 1{,}039' 6\frac{3}{4}" =$
15. $298' \frac{3}{4}" - 179' 4\frac{1}{2}" =$

16. A builder ordered 293 cu. yds of concrete. Of this amount, $201\frac{1}{4}$ cu. yds. were used for a foundation, $27\frac{1}{3}$ cu. yds. for column footings, $61\frac{1}{2}$ cu. yds. for the foundation footings, and $2\frac{3}{4}$ cu. yds. for areaways. How much concrete was left?

17. A builder, getting ready to pour a cellar floor, found that the worker had leveled the dirt at the finished-floor height. The builder had to dig out $39\frac{1}{2}$ cu. yds. of dirt to get the proper depth, and then fill in $19\frac{3}{4}$ cu. yds. of gravel. Then the builder had to lay the concrete floor on top of the gravel. How much concrete did the builder use for the floor?

REVIEW PROBLEMS:

18. A builder bought 58,750 brick and used 17,850 on one job, 22,395 on a second job, and 18,125 on the third job. How many brick were left?

19. A builder had a total payroll of $3,989.68. The carpenters were paid $1,284.85, the bricklayers were paid $1,437.60, the laborers were paid $1,018.69. How much were the timekeeper and superintendent paid?

20. A builder bought 389 bags of cement for several jobs. On the first job 108 bags were needed, 214 bags on the second job, 49 bags on the third job, and 47 bags on the fourth job. How did the fourth job work out?

(If you use a calculator, give your answer correct to the nearest whole inch.)

SUBTRACT:

1. $125' \; 4\frac{5}{8}'' - 67' \; 8\frac{1}{4}'' =$
2. $79' \; 10\frac{1}{4}'' - 43' \; 5'' =$
3. $1{,}343' \; \frac{7}{8}'' - 391' \; 4\frac{9}{16}'' =$
4. $234' - 87' \; 5\frac{1}{4}'' =$
5. $352' \; 4'' - 253' \; 1\frac{5}{8}'' =$
6. $12' \; \frac{3}{4}'' - 7' \; 5'' =$
7. $191' \; 7\frac{5}{8}'' - 90' \; 4\frac{7}{16}'' =$
8. $57' \; 4\frac{3}{8}'' - 28' \; 8\frac{1}{2}'' =$
9. $1{,}455' \; 6\frac{1}{2}'' - 444' \; 8'' =$
10. $3{,}282' \; 5\frac{1}{4}'' - 2{,}879' \; 4\frac{3}{8}'' =$

ADD:

11. $3' + 11\frac{1}{2}'' + 155' \; 6'' + \frac{3}{4}'' =$
12. $17' \; 2'' + 82' + 33' \; 5\frac{3}{4}'' + 11\frac{1}{2}'' =$
13. $92' \; 8\frac{5}{8}'' + 9\frac{3}{4}'' + 5' \; 6'' + 8\frac{1}{8}'' =$
14. $2' \; 6\frac{1}{2}'' + 5' \; 9'' + 12\frac{1}{2}'' + 47' \; \frac{5}{8}'' =$
15. $88' \; 9'' + 1{,}459' + 32' \; \frac{3}{4}'' + 11\frac{7}{8}'' =$

16. The dimensions of the sides of an irregularly shaped building are $17' \; 9\frac{1}{2}''$, $21' \; 6''$, $18' \; 5\frac{7}{8}''$, $4'$, $18' \; 11\frac{1}{2}''$, and $6' \; \frac{1}{2}''$. What is the perimeter of the building?

17. A builder ordered 67 cu. yds. of concrete. The supplier was told to deliver $18\frac{1}{2}$ cu. yds. to the first job, $23\frac{3}{4}$ cu. yds. to the second job, and $16\frac{2}{3}$ cu. yds. to the third job. How much concrete was left for job #4?

REVIEW PROBLEMS:

18. A builder drew $3,859.67 from the bank. The masons were paid $1,246.89, the laborers $1,045.28, and the carpenters $1,258.67. How much was left for the builder?

19. A builder ordered 79,500 face brick, 28,750 common brick and 9,850 blocks for four jobs. To job #1, 26,500 face brick, 2,750 common brick and 2,910 blocks were delivered; to job #2, 8,750 face brick and 2,290 blocks were delivered; to job #3, 12,450 common brick and 1,350 blocks were delivered. How many face brick, common brick, and blocks were delivered to job #4?

20. A builder paid $1,296.59 to the masons, $1,188.48 to the carpenters, $946.79 to the laborers, and $678.50 to the clerks, superintendent, and engineer. What was the total payroll?

Next assignment will be Test No. 2.

OBJECTIVE: To learn the methods of multiplying fractions.

INFORMATION:

There are various kinds of problems in the multiplication of fractions. By following the explanation below, you should be able to solve the different types of problems.

Neatness and careful placing of numbers is very important.

PROBLEM: $\frac{1}{3} \times 7 =$ (a fraction times a whole number)

Write both the whole number and the fraction as fractions. $\frac{1}{3} \times \frac{7}{1} =$

Multiply the upper numbers (numerators).
Multiply the lower numbers (denominators).
Reduce to the lowest terms.

$\frac{1}{3} \times \frac{7}{1} = \frac{7}{3}$

$= 2\frac{1}{3}$ ANS.

PROBLEM: $6 \times 1\frac{1}{4} =$ (a whole number times a mixed number)

Change both numbers to improper fractions. $\frac{6}{1} \times \frac{5}{4} =$

Multiply the numerators; multiply the denominators. $\frac{6}{1} \times \frac{5}{4} = \frac{30}{4}$

Reduce to the lowest terms. $\frac{30}{4} = \frac{15}{2} = 7\frac{1}{2}$ ANS.

PROBLEM $\frac{3}{4} \times \frac{1}{2} =$ (a fraction times a fractions)

Multiply the numerators; multiply the denominators. $\frac{3}{4} \times \frac{1}{2} = \frac{3}{8}$ ANS.

In order to reduce the size of the totals when you multiply fractions, use **cancellation** whenever possible. If a numerator will divide evenly into a denominator, or a denominator into a numerator, do so. When a number can be divided evenly into both a denominator **and** a numerator, do so.

PROBLEM: $\frac{3}{4} \times \frac{8}{9} =$

4 divides into 8 twice. Cross out the 4 and write 1 under it. Cross out the 8 and write 2 above it. 3 divides into 9 three times. Cross out the 3 and write 1 above it. Cross out the 9 and write 3 below it. This changes the numerators and denominators. Now multiply the new numerators and denominators.

numerators → $\frac{\cancel{3}^{1}}{\cancel{4}_{1}} \times \frac{\cancel{8}^{2}}{\cancel{9}_{3}} = \frac{2}{3}$ ANS.
denominators →

PROBLEM: $123 \times 14\frac{1}{4}$

Change to improper fractions. $\frac{123}{1} \times \frac{57}{4} =$

No cancellation is possible. Multiply the numerators, then multiply the denominators. Divide the denominator into the numerator.

$$\frac{123}{1} \times \frac{57}{4} = \frac{7011}{4} = 1752\frac{3}{4} \text{ ANS.}$$

Alternate Method:

Set up problem as an ordinary multiplication example.

$$\begin{array}{r} 123 \\ \times 14\frac{1}{4} \\ \hline \end{array}$$

Multiply $\frac{1}{4} \times 123 = 30\frac{3}{4}$ ..... $30\frac{3}{4}$

Then multiply 14×123 ..... $\begin{array}{r} 492 \\ 123 \\ \hline 1752\frac{3}{4} \end{array}$ ANS.

PROBLEM: $56\frac{1}{3} \times 29\frac{1}{4} =$

Change to improper fractions. Cancel. Multiply.

$$\frac{169}{3} \times \frac{\overset{39}{\cancel{117}}}{4} = \frac{6591}{4} = 1647\frac{3}{4} \quad \text{ANS.}$$

Alternate method:

It is quite possible to multiply $\begin{array}{r} 56\frac{1}{3} \\ \times 29\frac{1}{4} \\ \hline \end{array}$ in the form shown here.

The method is quite complicated, however, and it is easy to make mistakes. It is best to work a problem of this sort as a problem in multiplication of decimals.

$$56.333 \times 29.25 = 1647.74$$

To multiply dimensions (feet and inches), first change the inches in each dimension to a fraction of a foot. Then multiply as you do mixed numbers.

PROBLEM: $16'\ 9'' \times 18'\ 3'' =$

Change to feet and fractions of a foot. $16\frac{3}{4}' \times 18\frac{1}{4}' =$

Change to improper fractions and multiply.

$$\frac{67}{4}' \times \frac{73}{4}' = \frac{4891}{16}' = 305\frac{11}{16} \text{ sq. ft. ANS.}$$

When you multiply feet X feet, the answer is always in square feet.

Alternate method:

Use decimals. 16.75 x 18.25 = 305.6875 sq. ft.

For most purposes it will be enough to round off the number of square feet in the answer to tenths. Your answer would be 305.7 square feet.

Both answers contain fractions of a foot – the first a common fraction; the second a decimal fraction. If you really need the answer in square feet and square inches, you can multiply either fraction by 144, which is the number of square inches in one square foot. Try it and see whether you get 99 square inches. The whole answer will then be 305 sq. ft., 99 sq. in.

Remember, when changing inches to a fraction of a foot, that there are 12" in 1'.

When multiplying fractions, make a rough check of the answer by multiplying the whole numbers and comparing the rough answer with the exact answer. Always make sure your answer *makes sense* in terms of the given amounts.

Follow the directions on Information Sheet No. 8 so you will learn to multiply fractions quickly and easily. Try different methods and adopt the method that is easier for you. Many people find that it is easier to work with fractions when the numbers and fractions are small, and easier to work with decimals when they are large.

When multiplying fractions, be sure to make a rough check. When using decimals, give your answer correct to the nearest *hundredth.*

Multiply:

1. $4\frac{1}{3} \times 3\frac{1}{4} =$
2. $5\frac{1}{2} \times 6\frac{1}{2} =$
3. $6\frac{2}{5} \times 5\frac{1}{4} =$
4. $\frac{1}{2} \times \frac{1}{2} =$
5. $\frac{3}{4} \times \frac{1}{2} =$
6. $\frac{1}{3} \times 7 =$
7. $20 \times \frac{1}{6} =$
8. $5\frac{1}{3} \times 6\frac{1}{3} =$
9. $8\frac{3}{4} \times 12\frac{1}{4} =$
10. $9\frac{1}{6} \times 11\frac{1}{4} =$
11. $4\frac{5}{6} \times 12\frac{1}{2} =$
12. $6\frac{1}{4} \times 7\frac{2}{3} =$
13. $102\frac{1}{2} \times 11\frac{1}{3} =$
14. $76\frac{1}{3} \times 6\frac{3}{4} =$
15. $88\frac{1}{6} \times 7\frac{1}{2} =$
16. $81\frac{3}{4} \times 6\frac{2}{3} =$
17. $\frac{1}{5} \times \frac{5}{6} =$
18. $1\frac{1}{4} \times 2\frac{1}{2} =$
19. $42\frac{1}{2} \times 8 =$
20. $36\frac{2}{3} \times 51\frac{5}{12} =$
21. $16\frac{1}{3} \times 15\frac{3}{4} =$
22. $17\frac{1}{2} \times 9 =$
23. $21 \times 12\frac{1}{4} =$
24. $6\frac{1}{3} \times 7\frac{3}{4} =$
25. $10\frac{3}{4} \times 11\frac{2}{3} =$
26. $18\frac{1}{2} \times 17\frac{3}{4} =$
27. $9\frac{3}{4} \times 17 =$
28. $33\frac{1}{3} \times 44\frac{1}{2} =$
29. $\frac{7}{8} \times 2\frac{2}{3} =$
30. $19\frac{3}{8} \times 8\frac{1}{2} =$
31. $5\frac{3}{4} \times 6\frac{2}{3} =$
32. $21\frac{1}{3} \times 23\frac{2}{3} =$
33. $11\frac{3}{4} \times 3\frac{1}{2} =$
34. $15 \times \frac{1}{12} =$
35. $21\frac{3}{4} \times 12\frac{2}{3} =$
36. $14\frac{1}{2} \times 9\frac{1}{4} =$
37. $7\frac{1}{4} \times 4\frac{2}{3} =$
38. $3\frac{5}{6} \times 2\frac{1}{2} =$
39. $\frac{5}{8} \times 5\frac{1}{3} =$
40. $122\frac{1}{3} \times 97\frac{2}{3} =$

Do the work as directed on Information Sheet No 8. Remember to make a rough check. Give answers correct to the nearest *tenth* when using decimals.

Multiply:

1. $\frac{3}{4} \times 5\frac{1}{3} =$
2. $\frac{3}{8} \times 1\frac{1}{3} =$
3. $\frac{1}{6} \times 1\frac{1}{5} =$
4. $\frac{2}{3} \times 3\frac{3}{4} =$
5. $2\frac{1}{2} \times \frac{3}{10} =$
6. $4\frac{1}{2} \times \frac{2}{3} =$
7. $7\frac{1}{2} \times 3\frac{1}{3} =$
8. $2\frac{1}{7} \times 2\frac{1}{3} =$
9. $1\frac{1}{3} \times 2\frac{1}{2} =$
10. $12\frac{3}{8} \times 11\frac{3}{5} =$
11. $2\frac{2}{3} \times 3\frac{3}{4} =$
12. $1\frac{4}{5} \times 3\frac{1}{3} =$
13. $3\frac{1}{4} \times 2\frac{2}{3} =$
14. $3\frac{7}{8} \times 3\frac{1}{5} =$
15. $1\frac{3}{4} \times 2\frac{1}{3} \times 1\frac{1}{2} =$
16. $4\frac{1}{2} \times 4\frac{2}{3} \times 5\frac{1}{2} =$
17. $5\frac{1}{4} \times 2\frac{2}{3} \times 4\frac{1}{2} =$
18. $3\frac{1}{8} \times 2\frac{4}{5} \times 2\frac{1}{3} =$
19. $2\frac{5}{8} \times 2\frac{1}{3} \times 2\frac{2}{7} =$
20. $6\frac{2}{3} \times 3\frac{3}{4} \times 1\frac{1}{5} =$
21. $18\frac{1}{4} \times 42\frac{3}{8} =$
22. 55′ 4″ × 63′ 8″ =
23. 21′ 3″ × 43′ 6″ =
24. 37′ 5″ × 11′ 8″ =
25. 14′ 6″ × 21′ 9″ =
26. 33′ 4″ × 22′ 3″ =
27. 91′ 2″ × 7′ 3″ =
28. 77′ × 21′ 6″ =
29. 147′ × 15′ 3″ =
30. 36′ × 21′ 2″ =
31. 63′ × 31′ 1″ =
32. 29′ 4″ × 27′ 4″ =
33. 37′ 9″ × 33′ 8″ =
34. 72′ 8″ × 25′ 3″ =
35. 66′ 9″ × 21′ 4″ =
36. 189′ 2″ × 4′ 9″ =
37. 65′ 3″ × 27′ 8″ =
38. 57′ 8″ × 29′ 3″ =
39. 81′ 6″ × 37′ 4″ =
40. 55′ 4″ × 63′ 8″ =

1. How much is the total payroll for 11 workers who put in 6 days each, 7 hours per day, and earned $5.75 per hour?

2. A contractor built a foundation for $14,000. Labor cost $5,306.75, and the overhead came to $1,927.50. Materials cost the following: 21,000 brick @ $132.00 per 1,000; 225 bags of mortar cement @ $2.75 per bag; and 18 tons of sand @ $6.10 per ton. How much did the contractor make on that job?

3. It takes $6\frac{3}{4}$ brick to face 1 sq. ft. of wall. How many brick are needed to face a wall 73′ 6″ long and 6′ high?

ADD:

4. $8\frac{1}{2}'' + 10' 5\frac{3}{4}'' + 155' \frac{5}{8}'' + 29' 9\frac{3}{8}'' =$

5. $7' \frac{3}{8}'' + 21' 9\frac{1}{4}'' + 11\frac{1}{2}'' =$

SUBTRACT:

6. $2{,}059' 11\frac{3}{16}'' - 1{,}039' 6\frac{3}{4}'' =$
7. $298' \frac{1}{8}'' - 198' 6\frac{1}{2}'' =$

MULTIPLY:

(If using a calculator, give answer correct to the nearest tenth of a square foot.)

8. 43′ × 17′ 4″ =
9. 24′ 4″ × 18′ 6″ =
10. 36′ 8″ × 28′ 9″ =
11. 47′ 3″ × 32′ 2″ =
12. 19′ 6″ × 27′ 4″ =
13. 256′ 2″ × 11′ 3″ =
14. 79′ 3″ × 23′ 9″ =
15. 14′ 8″ × 13′ 9″ =

Multiplication of Fractions
(Feet and Inches, Quantities, Costs) **Assignment Sheet No. 15**

Make a rough check wherever appropriate in the following problems:

1. Nine laborers worked 5 days each, 8 hours per day, and earned a total of $2,790.00. How much did each worker earn per hour?

2. A contractor built a foundation for $32,000.00. Labor cost $12,928.65, and the overhead came to $4,826.50. Materials cost as follows: 23 cu. yds. of concrete @ $32.00 per yard; 37,500 brick @ $145.50 per 1,000; 1,750 concrete blocks @ 44¢ per block; 294 bags of mortar cement @ $2.75 per bag and 29 tons of sand at $6.15 per ton. How much did the contractor make?

3. It takes $6\frac{1}{2}$ brick to face 1 sq. ft. of wall. How many brick are needed to face a wall 288′ long and 8′ 8″ high?

ADD:

4. $1{,}101'\ 4\frac{1}{4}'' + 7\frac{3}{8}'' + 247'\ 1\frac{1}{2}'' + 79'\ 11\frac{1}{2}'' + 33' =$
5. $8'' + 1{,}042'\ 6\frac{3}{8}'' + 198'\ \frac{5}{8}'' + 7'\ 3'' =$

SUBTRACT:

6. $795'\ 6'' - 694'\ \frac{1}{2}'' =$
7. $456'\ 9\frac{3}{8}'' - 429'\ 8\frac{1}{8}'' =$

MULTIPLY:

(If using a calculator, give answer correct to the nearest tenth of a square foot.)

8. $36'\ 8'' \times 39'\ 9'' =$
9. $27'\ 9'' \times 48'\ 8'' =$
10. $78'\ 3'' \times 26'\ 6'' =$
11. $127'\ 8'' \times 19'\ 9'' =$
12. $16'\ 4'' \times 21'\ 3'' =$
13. $37'\ 6'' \times 33'\ 8'' =$
14. $37'\ 2'' \times 21'\ 8'' =$
15. $14'\ 9'' \times 12'\ 4'' =$

Next try Test #3.

Make a rough check wherever appropriate in the following problems:

1. Fifteen bricklayers laid 92,610 brick in 9 days, working 7 hours per day. How many brick did each worker average in 1 hour?

2. A contractor built a foundation for $22,500. Labor cost $9,608.75, and the overhead came to $1,396.85. Materials cost the following: 21 cu. yds. of concrete @ $32.50 per yard; 16,000 brick @ $136.00 per 1,000; 9,000 brick @ $174.50 per 1,000; 295 bags of mortar cement @ $2.75 per bag; and 23 tons of sand @ $6.15 per ton. How much did the contractor make?

3. Nine masons worked 7 days each, 8 hours per day. Each earned $12.50 per hour. How much was the total payroll?

ADD:

4. $141' \ 2\frac{3}{4}'' + 9\frac{1}{2}'' + 21' + 23' \ 11\frac{7}{8}'' + 7\frac{3}{4}'' =$
5. $7' \ 11'' + 100' + 42' \ 8\frac{3}{4}'' + 6\frac{7}{8}'' + 2' \ 9\frac{1}{4}'' =$

SUBTRACT:

6. $1{,}468' \ \frac{3}{4}'' - 457' \ 5\frac{1}{2}'' =$
7. $3{,}246' \ 7\frac{1}{4}'' - 2{,}468' \ 9'' =$

MULTIPLY:

8. $2' \ 6'' \times 3' \ 4'' =$
9. $5' \ 3'' \times 3' \ 4'' =$
10. $27' \ 3'' \times 16' \ 8'' =$
11. $89' \times 23' \ 4'' =$
12. $32' \ 9'' \times 55' \ 8'' =$
13. $79' \ 3'' \times 23' \ 9'' =$
14. $36' \ 8'' \times 28' \ 9'' =$
15. $19' \ 6'' \times 27' \ 4'' =$

Multiplication of Fractions
(Feet and Inches, Quantities, Costs) **Assignment Sheet No. 17**

1. Seven bricklayers working 7 days each, 8 hours per day, averaged 117 brick per hour. How many brick did each average per day?

2. It takes $6\frac{1}{2}$ brick to cover 1 sq. ft. of wall. How many brick are needed to cover the face of a wall 179′ 6″ long and 6′ high?

3. A builder put up a foundation for $29,600.00. Labor cost $12,896.25 and the overhead came to $2,469.00. Materials cost the following: 32,500 brick @ $145.75 per 1,000; 1,250 block @ 43¢ each; 289 bags of mortar cement @ $2.75 per bag; and 30 tons of sand @ $5.95 per ton. How much did the builder make?

ADD:

4. $627' \ 8\frac{5}{8}'' + 72' \ \frac{1}{2}'' + 9\frac{1}{4}'' + 17' \ \frac{7}{16}'' + 143' \ 7\frac{3}{8}'' =$
5. $569' \ \frac{3}{4}'' + 79' \ 6\frac{3}{16}'' + 125' \frac{1}{2}'' + 7'' + 47' \ 3\frac{7}{8}'' =$

SUBTRACT:

6. $789' \ 7'' - 279' \ \frac{5}{8}'' =$
7. $3{,}279' \ \frac{5}{16}'' - 1{,}378' \ 6\frac{3}{8}'' =$

MULTIPLY:

8. 2′ 8″ × 4′ 9″ =
9. 18′ 4″ × 17′ 8″ =
10. 14′ 6″ × 21′ 9″ =
11. 23′ 8″ × 19′ 3″ =
12. 77′ 3″ × 26′ 8″ =
13. 33′ 4″ × 22′ 3″ =
14. 47′ 8″ × 39′ 9″ =
15. 91′ 2″ × 7′ 3″ =

Make a rough check wherever appropriate in the following problems:

1. It takes $6\frac{3}{4}$ brick to face 1 sq. ft. of wall. How many brick are needed to face a wall 245′ 6″ long and 7′ high?

2. A builder put up a foundation for $29,500. Labor cost $12,013.65 and the overhead came to $3,142.50. Materials cost the following: 27 cu. yds. of concrete @ $30.50 per yard; 34,500 brick @ $132.00 per 1,000; 1,900 block @ 44¢ each; 269 bags of mortar cement @ $2.80 per bag; and 27 tons of sand @ $6.05 per ton. How much did the builder make?

3. What is the cost of an I-beam 27′ 6″ long which weighs $37\frac{1}{4}$ lbs. per lineal foot and costs $.221 per lb.?

ADD:

4. $6' \; 8\frac{3}{4}'' + 257' + 32' \; \frac{13}{16}'' + 4' \; 11\frac{7}{8}'' + 11\frac{9}{16}'' =$
5. $11'' + 2' \; \frac{5}{8}'' + 826' + 9' \; \frac{9}{16}'' + 42' \; 11\frac{1}{2}'' =$

SUBTRACT:

6. $2{,}685' \; \frac{1}{8}'' - 1{,}597' \; 11\frac{3}{4}'' =$
7. $196' \; 8\frac{3}{8}'' - 89' \; 9\frac{1}{2}'' =$

MULTIPLY:

8. $37' \times 21' \; 4'' =$
9. $3' \; 9'' \times 4' \; 4'' =$
10. $14' \; 6'' \times 21' \; 9'' =$
11. $43' \; 6'' \times 17' \; 4'' =$
12. $24' \; 4'' \times 18' \; 6'' =$
13. $15' \; 2'' \times 16' \; 3'' =$
14. $72' \; 9'' \times 27' \; 4'' =$
15. $188' \; 6'' \times 15' \; 3'' =$
16. $36' \; 8'' \times 14' \; 9'' =$

Next try Test #4.

OBJECTIVE: To learn how to divide fractions.

INFORMATION:

When you divide a quantity, you separate it into portions which are the same size.

When you **divide** 6 by 2 ($2\overline{)6}$), you get the same answer as you do when you **multiply** $6 \times \frac{1}{2}$. $\frac{6^{3}}{1} \times \frac{1}{2_{1}} = 3$

This gives us another way of doing division problems, particularly convenient when we are dealing with fractions. In each case, this is what we do:

1. Change **both** numbers to fractions ($\frac{6}{1} \div \frac{2}{1}$).
2. **Invert** the divisor mentally ($\frac{1}{2}$).
3. **Multiply** the number by the inverted divisor ($\frac{6^{3}}{1} \times \frac{1}{2_{1}}$) = 3 ANS.

PROBLEM: $\frac{5}{8} \div 6$ (divisor) =

Change to fractions. $\frac{5}{8} \div \frac{6}{1} =$

Invert the divisor and multiply. $\frac{5}{8} \times \frac{1}{6} = \frac{5}{48}$ ANS.

PROBLEM: $7 \div 1\frac{3}{4}$ (divisor) =

Change to improper fractions. $\frac{7}{1} \div \frac{7}{4} =$

Invert the divisor and multiply, using cancellation. $\frac{7_{1}}{1} \times \frac{4}{7_{1}} = \frac{4}{1} = 4$ ANS.

PROBLEM: $5\frac{1}{3} \div 4 =$

Change to improper fractions. $\frac{16}{3} \div \frac{4}{1} =$

Invert the divisor, then multiply. Cancel. $\frac{16^{4}}{3} \times \frac{1}{4} = \frac{4}{3} = 1\frac{1}{3}$ ANS.

PROBLEM: $15\frac{7}{12} \div 3\frac{2}{3} =$

$\frac{187}{12} \div \frac{11}{3} =$

$\frac{187^{17}}{12_4} \times \frac{3}{11} = \frac{17}{4} = 4\frac{1}{4}$ ANS.

To divide dimensions (feet and inches) you change the inches to a fraction of a foot. Then solve the problem in the regular way. (You have not forgotten that 12" = 1'!)

PROBLEM: $10'\ 6'' \div 4\frac{1}{2} =$

Change to feet and a fraction of a foot. $10\frac{1}{2}' \div 4\frac{1}{2} =$

Change to improper fractions. $\frac{21}{2} \div \frac{9}{2} =$

Invert the divisor, then multiply. $\frac{21^{7}}{2} \times \frac{2}{9_3} = \frac{7}{3} = 2\frac{1}{3}'$

Change the $2\frac{1}{3}'$ to feet and inches. $2\frac{1}{3}' = 2'\ 4''$ ANS.

Make a rough check of your answer by multiplying the whole number of the answer by the whole number of the divisor. Or better still, multiply your entire answer by the divisor.

$2'\ 4'' = 2\frac{1}{3}' \times 4\frac{1}{2} = \frac{7}{3} \times \frac{9}{2} = \frac{63}{6} = 10\frac{3}{6} = 10\frac{1}{2}' = \boxed{10'\ 6''}$

By calculator

Where you know the decimal equivalent of the fractions, simply enter your first number, ÷ sign, divisor, and = sign. Then convert any decimal part of a foot to inches if that's what the problem calls for.

For the above problem, for example:

Enter: 10.5, ÷, 4.5, = Display: 2.3333333

Answer: $2\frac{1}{3}' = 2'\ 4''$

(If you need to divide out a fraction to get its decimal equivalent, you will have to work with that part first. You may have to put the whole-number part plus the fractional part of the number into memory before tackling the division.)

Be particularly careful when changing mixed numbers to improper fractions. Most errors are made at this point. Follow the directions of Information Sheet No. 9.

DIVIDE THESE FRACTIONS:

1. $\frac{9}{16} \div 3 =$
2. $\frac{15}{16} \div 5 =$
3. $\frac{3}{2} \div 3 =$
4. $\frac{27}{64} \div 9 =$
5. $\frac{63}{100} \div 9 =$
6. $\frac{48}{9} \div 4 =$
7. $\frac{56}{6} \div 4 =$
8. $\frac{72}{4} \div 6 =$
9. $10 \div 2\frac{1}{2} =$
10. $14 \div 3\frac{1}{3} =$
11. $21 \div 2\frac{2}{3} =$
12. $17 \div 1\frac{1}{4} =$
13. $18 \div 5\frac{1}{3} =$
14. $16 \div 1\frac{1}{2} =$
15. $9 \div 4\frac{1}{4} =$
16. $13 \div 1\frac{2}{3} =$

Use your calculator for these.
(Give answer correct to 2 decimal places if necessary.)

17. $27\frac{1}{2} \div 6\frac{1}{4} =$
18. $18\frac{3}{4} \div 2\frac{1}{2} =$
19. $22\frac{2}{3} \div 1\frac{3}{4} =$
20. $24\frac{3}{4} \div 8\frac{1}{4} =$
21. $16\frac{1}{2} \div 4\frac{1}{3} =$
22. $17\frac{1}{4} \div 2\frac{1}{2} =$
23. $15\frac{1}{3} \div 2\frac{2}{3} =$
24. $18\frac{1}{2} \div 4\frac{1}{2} =$

In the following problems, give your answer in number of feet and whole inches.

25. $16' 9'' \div 3 =$
26. $17' 6'' \div 2 =$
27. $18' 4'' \div 3 =$
28. $12' 9'' \div 2 =$
29. $24' 6'' \div 5 =$
30. $8' 8'' \div 2 =$

Division of Fractions
(Feet and Inches) **Assignment Sheet No. 20**

In solving the following problems, be particularly careful when dealing with fractions of a foot. Make a rough check. (Use whatever method you prefer.)

DIVIDE:

1. $9\frac{3}{8} \div 3\frac{3}{4} =$
2. $22\frac{2}{3} \div 4\frac{1}{4} =$
3. $7\frac{7}{12} \div 4\frac{1}{3} =$
4. $8\frac{3}{4} \div 2\frac{1}{2} =$
5. $15\frac{1}{2} \div 3\frac{1}{3} =$
6. $23\frac{3}{8} \div 4\frac{1}{4} =$
7. $94\frac{13}{16} \div 5\frac{1}{8} =$
8. $92\frac{1}{2} \div 7\frac{1}{2} =$
9. $32\frac{5}{8} \div 4\frac{1}{2} =$
10. $89\frac{1}{16} \div 6\frac{1}{4} =$
11. $28\frac{7}{8} \div 3\frac{1}{2} =$
12. $26\frac{1}{8} \div 5\frac{1}{2} =$
13. $19\frac{3}{8} \div 2\frac{1}{2} =$
14. $30\frac{3}{8} \div 6\frac{3}{4} =$
15. $55\frac{1}{4} \div 4\frac{1}{4} =$

In the following problems, work out your answer to feet and inches.

16. 110′ 6″ ÷ 8 =
17. 34′ 9″ ÷ 4 =
18. 55′ ÷ 6 =
19. 97′ 6″ ÷ 4 =
20. 87′ 10″ ÷ 11 =
21. 33′ 3″ ÷ 7 =
22. 39′ 0″ ÷ 3 =
23. 55′ 3″ ÷ 4 =
24. 42′ 8″ ÷ 2 =
25. 71′ 9″ ÷ 3 =
26. 14′ 4″ ÷ 4 =
27. 80′ 6″ ÷ 6 =
28. 63′ 4″ ÷ 5 =
29. 124′ 3″ ÷ 7 =
30. 189′ 4″ ÷ 16 =
31. 53′ 4″ ÷ 4 =
32. 78′ 4″ ÷ 10 =
33. 97′ 3″ ÷ 3 =
34. 88′ 6″ ÷ 6 =
35. 139′ 7″ ÷ 5 =

OBJECTIVE: To learn to divide fractions and to divide quantities and areas into the standard units of measure used in the trade.

INFORMATION:

Sometimes you wish to find the number of square yards in a surface rather than the number of square feet. There are 9 square feet in 1 square yard. Therefore you can divide the number of square feet by 9, to get the answer in square yards.

Quantities of sand, gravel, concrete, and excavating are usually estimated and paid for by the cubic yard. There are 27 *cubic feet* in 1 *cubic yard.* To get the number of cubic yards, divide a given number of cubic feet by 27.

In problems 1-20, give your answer in feet and inches, as before. In problems 21-35, give your answer in square yards or cubic yards, as required, correct to one decimal place. Make a rough check.

DIVIDE:

1. 110′ 6″ ÷ 8 =
2. 34′ 10″ ÷ 4 =
3. 55′ ÷ 6 =
4. 97′ 6″ ÷ $4\frac{1}{2}$ =
5. 87′ 9″ ÷ 10 =
6. 33′ 3″ ÷ 7 =
7. 69′ 4″ ÷ $3\frac{1}{4}$ =
8. 55′ 3″ ÷ $4\frac{1}{3}$ =
9. 42′ 8″ ÷ $2\frac{2}{3}$ =
10. 71′ 9″ ÷ $3\frac{1}{2}$ =
11. 14′ 4″ ÷ 4 =
12. 80′ 6″ ÷ 6 =
13. 63′ 4″ ÷ 5 =
14. 124′ 3″ ÷ 7 =
15. 189′ 4″ ÷ 16 =
16. 53′ 4″ ÷ 4 =
17. 78′ 4″ ÷ 10 =
18. 88′ 6″ ÷ 6 =
19. 139′ 7″ ÷ 5 =
20. 20′ 2″ ÷ $2\frac{3}{4}$ =
21. $139\frac{1}{2}$ sq. ft. ÷ 9 =
22. $114\frac{3}{4}$ sq. ft. ÷ 9 =
23. 201 sq. ft. ÷ 9 =
24. $160\frac{1}{2}$ sq. ft. ÷ 9 =
25 $262\frac{1}{2}$ sq. ft. ÷ 9 =
26. $465\frac{3}{4}$ cu. ft. ÷ 27 =
27. $1{,}282\frac{1}{2}$ cu. ft. ÷ 27 =
28. $535\frac{1}{2}$ cu. ft ÷ 27 =
29. 1,071 cu. ft. ÷ 27 =
30. $388\frac{1}{8}$ cu. ft. ÷ 27 =
31. $178\frac{7}{8}$ sq. ft. ÷ 9 =
32. 231 sq. ft. ÷ 9 =
33. $87\frac{3}{4}$ sq. ft. ÷ 9 =
34. 1,812 cu. ft. ÷ 27 =
35. $1{,}300\frac{1}{2}$ cu. ft. ÷ 27 =

ADD:

1. $28' \ 9\frac{5}{8}'' + 145' \ \frac{1}{4}'' + 11\frac{1}{2}'' =$
2. $31' \ \frac{7}{8}'' + 47' \ 9\frac{3}{8}'' + 12' \ 2'' + 118' =$

SUBTRACT:

3. $2{,}059' \ 11'' - 1{,}039' \ 6\frac{3}{4}'' =$
4. $298' \ \frac{3}{4}'' - 179' \ 4\frac{1}{2}'' =$

MULTIPLY:

5. $66' \ 8'' \times 17' \ 3'' =$
6. $65' \ 8'' \times 46' \ 9'' =$

DIVIDE: (Answers to these to be correct to one decimal place.)

7. $63' \ 4'' \div 5 =$
8. $11' \ 3'' \div 9 =$
9. $2' \ 3'' \div 3 =$
10. $42' \ 9'' \div 3 =$
11. $23' \ 4'' \div 4 =$
12. $337\frac{1}{2}$ cu. ft. $\div 27 =$
13. $506\frac{1}{4}$ cu. ft. $\div 27 =$
14. $1{,}246\frac{1}{2}$ sq. ft. $\div 9 =$
15. $807\frac{3}{4}$ sq. ft. $\div 9 =$
16. $118\frac{2}{3}$ sq. ft. $\div 9$
17. Seven bricklayers worked 6 days each, 7 hours per day, and laid 32,046 brick. How many brick did each bricklayer average per hour?
18. Twelve laborers worked 14 days each, 7 hours per day, and earned a total of $8,820.00. How much did each bricklayer earn per day?
19. A builder put up a foundation for $32,200. Labor cost $12,127.65 and the overhead came to $2,669.75. Materials cost the following: 35 cu. yds. of concrete @ $31.50 per yard; 39,000 brick @ $145.00 per 1,000; 2,600 blocks @ .42 each; 358 bags of mortar cement @ $2.75 per bag; 40 tons of sand @ $6.25 per ton; and door bucks and window frames for $867.50. How much profit did the builder make?
20. How much would a 24' long I-beam weighing $27\frac{1}{2}$ lbs. per lineal ft. cost if each lb. costs $.218?
21. How many courses of brick are needed to build a wall 11' 11" high? The brick are to be laid 4 courses in 11".

You have reached the halfway mark in division of fractions. Cheer up, there is more to come. Remember to check your work.

ADD:

1. $133' + 8'' + 11' \frac{3}{4}'' + 89' 6'' =$
2. $7' + 101' 6'' + 8\frac{1}{2}'' + 92' 11\frac{3}{4}'' =$

SUBTRACT:

3. $69' 3\frac{1}{4}'' - 22' 8\frac{5}{8}'' =$
4. $4{,}270' - 1{,}485' 6\frac{5}{8}'' =$

MULTIPLY:

5. $129' 3'' \times 38' 8'' =$
6. $145' 9'' \times 129' 6'' =$

DIVIDE: (Answers correct to one decimal place)

7. $124' 3'' \div 7 =$
8. $88' 6'' \div 6 =$
9. $154' \div 8 =$
10. $18' 9'' \div 2\frac{1}{2} =$
11. $17' 4'' \div 4 =$
12. $4{,}079\frac{1}{4}$ sq. ft. $\div 9 =$
13. $3{,}989\frac{1}{4}$ cu. ft. $\div 27 =$
14. $841\frac{1}{2}$ sq. ft. $\div 9 =$
15. $2{,}139\frac{3}{4}$ cu. ft. $\div 27 =$
16. $51 \div 4\frac{1}{2} =$

17. Seventeen bricklayers worked 15 days, 7 hours per day each, and laid a total of 156,485 brick. How many brick per day did each bricklayer average?

18. Fifteen laborers worked 9 days each, 7 hours per day and earned $7.05 per hour. How much did they earn altogether?

19. How much does an I-beam 54' 6" long, weighing 39 lbs. per lineal foot, cost @ 24¢ per lb.?

20. A builder did a job for $33,000. Labor cost $12,015.00 and the overhead came to $2,406.50. Materials cost the following: 37 cu. yds. of concrete @ $29.60 per yard; 37,500 brick @ $139.00 per 1,000; 2,550 blocks @ $42\frac{1}{2}$¢ each; 269 bags of portland cement @ $3.10 per bag; 179 bags of lime @ $2.15 per bag; 38 tons of sand @ $6.05 per ton; door bucks, window frames and lintels for $847.65; the I-beam in problem #19; and 4 lally columns @ $9.50 each. How much profit did the builder make?

Check your answers to the following problems:

ADD:

1. $7' 6'' + 2' \frac{3}{4}'' + 9\frac{1}{2}'' + 11'' + 3\frac{1}{8}'' =$

SUBTRACT:

2. $17' 5'' - 9' 8\frac{1}{4}'' =$

MULTIPLY:

3. $17' 3'' \times 9' 6'' =$
4. $9' 8'' \times 15' 4'' =$
5. $73' 9'' \times 9' 8'' =$

DIVIDE:

6. $16' 4'' \div 4\frac{2}{3} =$
7. $10' 10'' \div 2\frac{1}{2} =$
8. $35' 9'' \div 4\frac{1}{3} =$
9. $25' 6'' \div 6 =$
10. 269 sq. ft. $\div 9 =$
11. $427\frac{1}{2}$ sq. ft. $\div 9 =$
12. $1{,}200$ sq. ft. $\div 9 =$
13. $418\frac{1}{2}$ cu. ft. $\div 27 =$
14. $1{,}005\frac{3}{4}$ cu. ft. $\div 27 =$
15. 657 cu. ft. $\div 27 =$

16. How much does a 37' 6" long I-beam weighing 33 lbs. per lineal foot cost @ 22¢ per lb.?

17. A builder put up a foundation for $13,400. Labor cost $2,295.75 and the overhead came to $953.50. Materials cost the following: 12,500 brick @ $145.75 per 1,000; 2,100 blocks @ $.44 per block; 27 cu. yds. of concrete @ $31.50 per yard; 30 tons of sand @ $6.25 per ton; 157 bags of mortar cement @ $2.79 per bag; and the I-beam in problem #16. How much did the builder make?

Check your answers to the following problems:

ADD:

1. $9' \frac{3}{4}'' + 11' + 12\frac{1}{2}'' + 4' 5'' + 3' 11\frac{7}{8}'' =$

SUBTRACT:

2. $72' 8\frac{1}{4}'' - 27' 10\frac{5}{8}'' =$

MULTIPLY:

3. $67' 8'' \times 34' 3'' =$
4. $8' 9'' \times 12' 4'' =$
5. $19' 6'' \times 17' 8'' =$

DIVIDE:

6. $18' 1'' \div 3\frac{1}{2} =$
7. $13' 9'' \div 3\frac{2}{3} =$
8. $25' 4'' \div 5\frac{1}{3} =$
9. $19' 3'' \div 7 =$
10. $348 \text{ sq. ft.} \div 9 =$
11. $787\frac{1}{2} \text{ sq. ft.} \div 9 =$
12. $1{,}400 \text{ sq. ft.} \div 9 =$
13. $1{,}282\frac{1}{2} \text{ cu. ft.} \div 27 =$
14. $1{,}052\frac{1}{4} \text{ cu. ft.} \div 27 =$
15. $723 \text{ cu. ft.} \div 27 =$

16. How much does a 29′ 6″ long I-beam weighing 41 lbs. per lineal foot cost @ 26¢ per lb.?

17. A builder put up a foundation for $13,500. Labor cost $2,579.85 and the overhead came to $1,015.60. Materials cost the following: 11,500 brick @ $145.00 per 1,000; 2,350 blocks @ $42\frac{1}{2}$¢ per block; 28 cu. yds. of concrete @ $29.80 per yard; 27 tons of sand @ $6.25 per ton; 170 bags of mortar cement @ $2.95 per bag; and the I-beam in problem #16. How much did the builder make?

Check your answers to the following problems:

ADD:

1. $7' 6'' + 12\frac{3}{4}'' + 2' \frac{7}{8}'' + 11' + 3' 9\frac{1}{4}'' =$

SUBTRACT:

2. $35' 8'' - 21' 9\frac{1}{4}'' =$

MULTIPLY:

3. $29' 8'' \times 35' 9'' =$
4. $9' 9'' \times 16' 4'' =$

DIVIDE:

5. $21' 8'' \div 6\frac{1}{2} =$
6. $19' 6'' \div 6 =$
7. $63' 9'' \div 5 =$
8. 423 sq. ft. $\div 9 =$
9. $265\frac{1}{2}$ sq. ft. $\div 9 =$
10. $1{,}250$ cu. ft. $\div 27 =$
11. $1{,}521$ cu. ft. $\div 27 =$
12. $985\frac{1}{2}$ cu. ft. $\div 27 =$

13. A patio measures 16′ by 18′. How many square yards does it cover?

14. A block 18″ long and 8″ high covers 1 sq. ft. of wall surface. How many block are needed for a wall 97′ 6″ long and 13′ high?

15. How many sq. yds. are in a wall 83′ long and 12′ high?

16. Seventeen bricklayers, working 8 hours per day each, laid 100,912 brick in 7 days. How many brick did each worker average per day?

17. A builder put up a foundation for $12,900. Labor cost $2,625.75 and overhead came to $1,250. Materials cost the following: 12,500 brick @ $168.00 per 1,000; 2,250 blocks @ $.42 per block; 27 cu. yds. of concrete @ $32.50 per yard; 29 tons of sand @ $6.00 per ton; 180 bags of mortar cement @ $2.95 per bag; and an I-beam 39 ft. long, weighing $27\frac{1}{2}$ lbs. per lineal foot, @ 24¢ per lb. How much did the builder make?

Remember to check your work in the following problems:

ADD:

1. $72' \frac{1}{2}'' + 2' 6'' + 9\frac{7}{8}'' + 11'' + 12' 1\frac{3}{4}'' =$

SUBTRACT:

2. $86' 9\frac{7}{16}'' - 47' 5\frac{3}{4}'' =$

MULTIPLY:

3. $17' 8'' \times 14' 6'' =$
4. $87' 8'' \times 17' 4'' =$

DIVIDE:

5. $43' 9'' \div 5\frac{1}{4} =$
6. $38' 9'' \div 5 =$
7. $12' 8'' \div 2\frac{2}{3} =$
8. 273 sq. ft. $\div 9 =$
9. $337\frac{1}{2}$ sq. ft. $\div 9 =$
10. $1{,}427$ cu. ft. $\div 27 =$
11. $1{,}167\frac{3}{4}$ cu. ft. $\div 27 =$
12. $526\frac{1}{2}$ cu. ft. $\div 27 =$

13. How much will an I-beam $27\frac{1}{2}'$ long cost? It weighs 42 lbs. per lineal foot and costs $.29 per pound.

14. How many square yards are there in a terrace $22' 4''$ long by $18' 6''$ wide?

15. It takes $6\frac{1}{4}$ brick to face 1 sq. ft. of wall. How many brick are needed to face a wall $137' 6''$ long and $9'$ high?

16. Seven laborers worked 8 hours per day for 9 days and earned $3,679.20. How much did each earn per hour?

17. A builder put up a foundation for $19,600. Labor cost $4,567.00 and the overhead came to $2,376.85. Materials cost the following: 18,500 brick @ $145.75 per 1,000; 2,850 blocks @ 42.5¢ per block; 32 cu. yds. of concrete @ $31.50 per yard; 23 tons of sand @ $6.25 per ton; 217 bags of mortar cement @ $3.00 per bag, 3 lally columns @ $10.50 each; and the I-beam in problem #13. How much did the builder make?

Now go on to Test #5 and #6.

Areas and Perimeters of Squares, Rectangles, Triangles, Circles — **Information Sheet No. 1**

OBJECTIVE: To learn how to find the area of the different shaped surfaces most often used in construction.

To learn to find perimeters.

INFORMATION:

Think! What you can do with your brain you do not have to do with your back.

Square measure is the method of finding out how much space the surface of an object or building covers. This is done by figuring out how many squares of a certain size are needed to cover the surface. The size of the surface is called its area. The unit of measure used most often is 1 foot.

Surfaces have different shapes. Squares, rectangles, triangles, and circles are encountered most.

Surfaces have no depth or thickness. They have only 2 dimensions, length and width (or height).

Square: A square is a 4-sided figure whose sides are all the same length and are at right angles to each other. The sides of a square are known as the length and width (or height).

To find the area of a square, multiply the length by the width (or height).
Fig. 1:
Length 2′
Height 2′

2′ × 2′ = 4 sq. ft., area of Fig. 1

The **perimeter** of a shape is the distance around it. The distance around this square is 2′ + 2′ + 2′ + 2′, or 4 × 2′. The perimeter of Fig. 1 is therefore 8′.

Since all the sides of a square are equal, the perimeter of any square is equal to 4 times the length of a side.

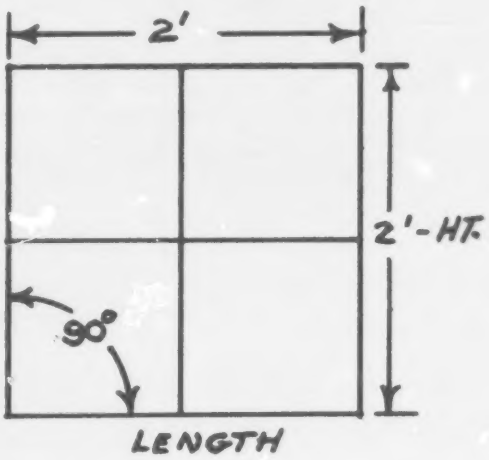


FIG. 1
SQUARE

Rectangle:
A rectangle is a 4-sided figure in which the sides opposite each other are the same size. The sides are at right angles to each other.

To find the area of a rectangle, multiply the length by the width (or height).
Fig. 2:

Length 3′
Height 2′

2′ × 3′ = 6 sq. ft., area of Fig. 2

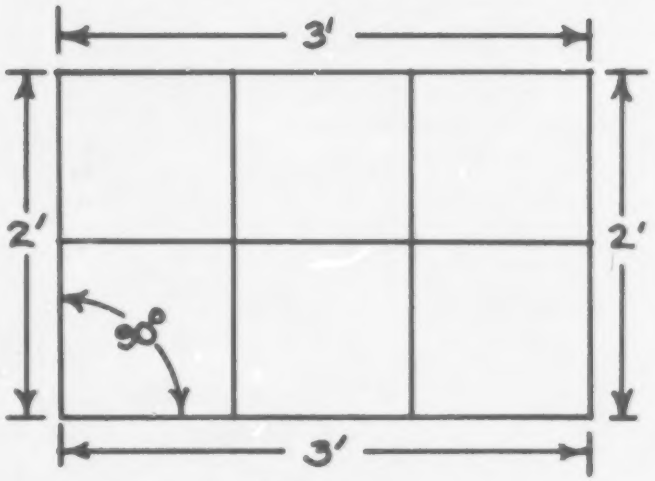


FIG. 2
RECTANGLE

The perimeter of this rectangle is 3′ + 2′ + 3′ + 2′ or 10 in all. Since opposite sides of a rectangle are equal, the perimeter is twice the length plus twice the width (or height). In this case, (2 × 3′) + (2 × 2′) = 10 feet, perimeter of Fig. 2.

Triangle: Triangles are 3-sided figures.

The bottom of the triangle is called the base.

The sides of the triangle are sometimes called legs.

The distance from the base to where the other legs or sides meet is called the height or altitude.

The triangles which you will use in estimating will be right triangles. Right triangles are those triangles which have one angle which is 90°.

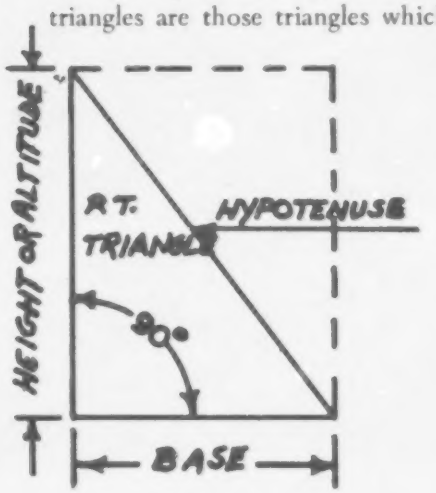


FIG. 3A

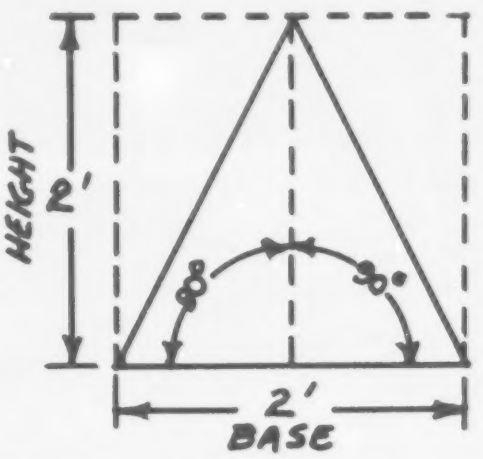


FIG. 3B

In Fig. 3A and Fig. 3B, you see that the triangles cover one half the area of the rectangle and square in which they have been drawn. The base of each triangle is the same size as the length of one side of both the rectangle and the square. The height of each triangle is the same as the length of the other side of the rectangle and square. Since the dimensions of the base and altitude (or height) of the triangles are the same as those of the square and rectangle, and since the triangles cover one half the area of the square and rectangle, to find the area of a triangle you multiply the base X height and divide the result by 2.

The standard formula is

$$\text{Area} = \frac{1}{2} \times \text{Base} \times \text{Height}$$

Using the dimensions in Fig. 3B,

$$\frac{1}{2} \times \text{Base} \times \text{Height} = \frac{1}{\cancel{2}_1} \times \frac{\cancel{2}^1}{1} \times \frac{2}{1} = 2 \text{ sq. ft., area of Fig. 3B}$$

In problems involving right triangles, many times you will have only 2 dimensions given. To find the third dimension you will use the "3-4-5" method.

In all right triangles, the square of the hypotenuse (the side opposite the right angle) is equal to the sum of the squares of the other two sides.

In Fig. 3C, the 2 sides are 3′ and 4′ long.

3 squared = 3 X 3 = 9
4 squared = 4 X 4 = 16
The sum of the squares of 3 and 4 = 25
5 squared = 5 X 5 = 25

When you multiply the 3-4-5 right triangle to increase the size of the sides, the results will be in the same proportion no matter what figure you use to multiply the sides by. Just be sure that you use the same multiplier for each side.

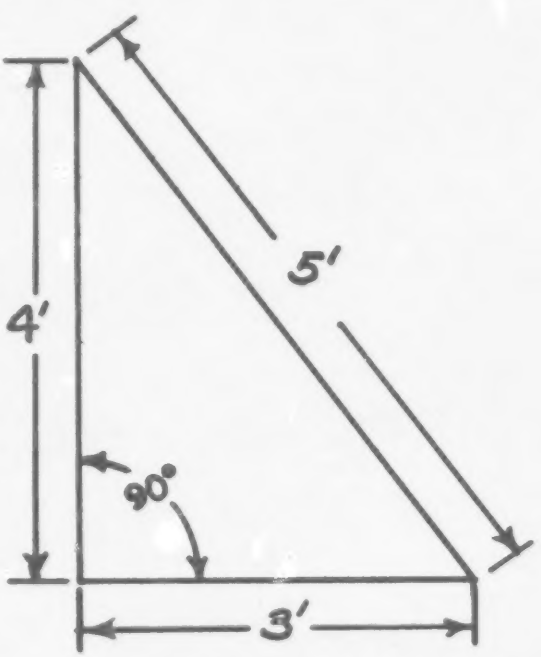


FIG. 3C

Let us increase a 3-4-5 right triangle so that each side will be 4 times this size.

$3 \times 4 = 12$; 12 squared $= 12 \times 12 = 144$
$4 \times 4 = 16$; 16 squared $= 16 \times 16 = 256$
The sum of the squares of 12 and 16 = 400
$5 \times 4 = 20$; 20 squared $= 20 \times 20 = 400$

A **Circle** (Fig. 4) is a figure whose outside edge is the same distance from the center throughout its length. The outside edge of a circle is a curve or arc. The entire curved edge of a circle is the **circumference**. The distance through the center of a circle is the **diameter**. The **radius** of a circle is the distance from the center of the circle to the circumference. The radius is $\frac{1}{2}$ the diameter.

To find the area of a circle, you must know the length of the radius, diameter, or circumference of the circle.

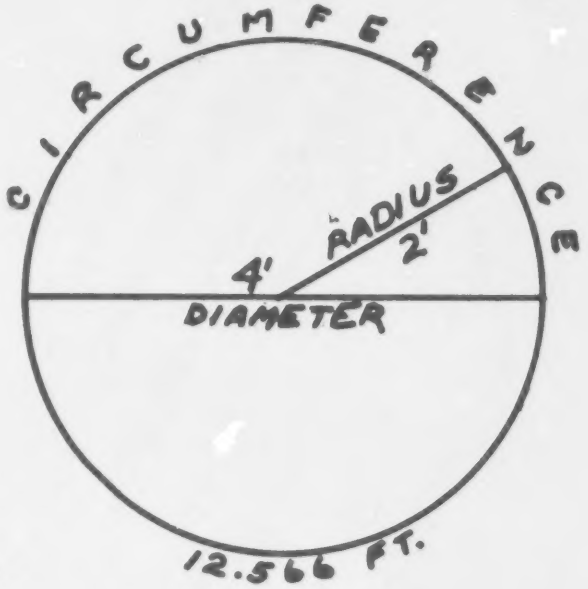


FIG. 4
CIRCLE

If you were to measure the circumference of any circle and compare its length with the length of the diameter, you would find that the circumference is always a little over three times the length of the diameter. Mathematicians have calculated that the figure is actually 3.1416 and have given this the name pi (the Greek letter p, written π). In working with circles it is generally necessary to use π, which for rough work is sometimes approximated as 3.14 or even $3\frac{1}{7}$.

To find the **radius** of a circle, you divide the **diameter** by 2. In Fig. 4, radius = 4 ÷ 2 = 2 (**radius** of Fig. 4).

To find the **circumference**, you multiply the **diameter** by π, that is

circumference = 3.1416 × diameter

In Fig. 4, circumference = 3.1416 × 4′ = 12.5664 ft. (**circumference** of Fig. 4)
= 12.6 ft., rounded off

To find the **diameter** of a circle when you know the circumference, you divide the **circumference** by π

$$\text{diameter} = \text{circumference} \div 3.1416$$

In Fig. 4, diameter = $12.5664 \div 3.1416 = 4$ (**diameter** of Fig. 4)

To find the area of a circle, you multiply π by the square of the radius (that is, $\pi \times$ radius $\times$ radius). This is written radius^2.

$$\text{area} = 3.1416 \times \text{radius}^2$$

In Fig. 4, area = $3.1416 \times 2' \times 2' = 12.5664$ sq. ft. (**area** of Fig. 4). This happens by coincidence to be the same numerical value as the circumference, but note that the area is always in **square** measure. (**Round the answer off as before.**)

To summarize the above facts about a circle, we can let c stand for the circumference, d for the diameter, r for the radius, and A for the area.

Then: $r = \frac{d}{2}$ or $d = 2 \times r$

$c = \pi \times d$ or $c = \pi \times r \times 2$

$d = \frac{c}{\pi}$

$A = \pi \times r^2$

To summarize the main ideas of this lesson:

Areas are measures of the amount of **surface** of something. They are calculated by **multiplying**, and the area is always given in **square measure**.

Perimeters are measures of **distance**. The perimeter of any object is the distance around it. The perimeter of a circle has a special name, **circumference**.

For a **rectangle**, the perimeter equals the sum of all four sides. But since the opposite sides are equal,

$$\text{perimeter} = 2 \times \text{length} + 2 \times \text{width}$$

In a **square**, all four sides are equal, so that

$$\text{perimeter} = 4 \times \text{length of a side}$$

Follow the instructions on Information Sheet No. 1 to solve the problems in this assignment. If you study the instructions carefully you will have no trouble solving the problems quickly and accurately. Remember: Area is expressed in sq. ft. When answers do not come out even, round them off to the nearest tenth of a foot or square foot.

1. Find the area of a 17′ square.
2. Find the area of a rectangle 27′ long and 19′ wide.
3. Find the area of a rectangle 43′ long and 29′ high.
4. Find the perimeter of a rectangle 36′ long and 27′ wide.
5. Find the perimeter of a 28′ square.
6. Find the area of a triangle whose base is 28′ and whose height is 17′.
7. Find the area of a circle whose radius is 12′.
8. Find the circumference of a circle whose diameter is 12′.
9. Find the area of a circle whose diameter is 14′.
10. Find the area of a triangle whose base is 18′ and whose altitude is 14′.
11. Find the perimeter of a right triangle whose base is 12′ and height 16′. Use 3-4-5 method.
12. Find the area of a rectangle 27′ 3″ long and 14′ 6″ wide.
13. Find the area of a circle whose diameter is 17′.
14. Find the circumference of a circle whose radius is 19′ 8″.
15. Find the area of a triangle whose base is 13′ and whose height is 13′.
16. Find the area of a 15′ 4″ square.
17. Find the radius of a circle whose circumference is 59.69 feet.
18. Find the area of a circle whose circumference is 84.82 feet.
19. Find the perimeter of a right triangle whose base is 24′ and height is 32′. Use 3-4-5 method.
20. Find the area of a triangle whose base is 19′ 6″ and whose height is 12′.
21. How many courses of brick are needed to build a wall 10′ 1″ high? The brick are to be laid 4 courses in 11″.

In this assignment you will find the areas of irregularly shaped surfaces.

To find the areas of Fig. A and Fig. B, first find the areas of each section and then add them. For convenience, we shall combine the capital letters to indicate a portion of the figure. For example, AB will mean A + B, BCD (in Fig. D) will mean B + C + D, etc.

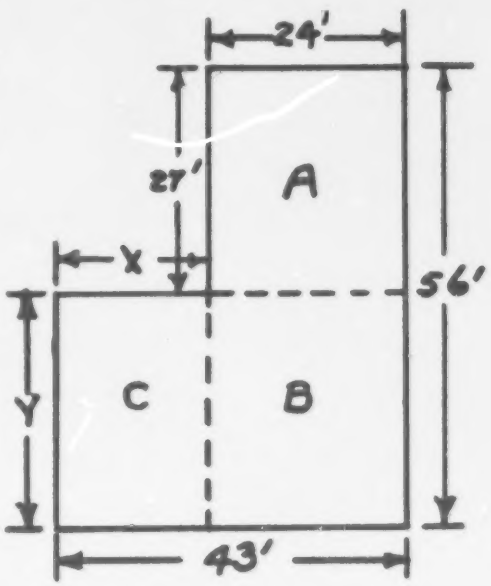


FIG. A

Fig. A

1. What is the length of dimension "X"?
2. What is the length of dimension "Y"?
3. What is the perimeter of Fig. A?
4. What is the area of A?
5. What is the area of C?
6. What is the area of B?
7. What is the area of AB?
8. What is the area of BC?
9. What is the area of ABC?

Fig. B

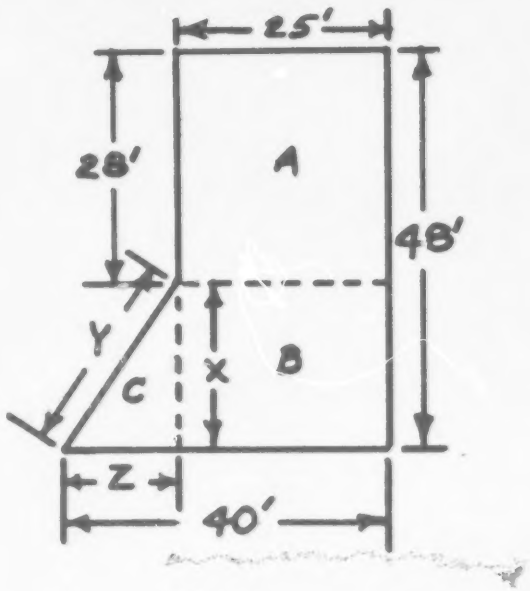


FIG. B

10. How long is dimension "Z"?
11. How long is dimension "Y"?
12. What is the perimeter of Fig. B?
13. What is the area of A?
14. What is the area of C?
15. What is the area of AB?
16. What is the area of AC?
17. What is the area of ABC?

18. What is the area of a triangle whose base is 17′ and whose height is 13′?
19. What is the area of a circle whose circumference is 53.41′?
20. What is the area of a 19′ square?
21. How many courses of block are needed to build a wall 16′ 6″ high? Each block course is laid in $8\frac{1}{4}$″.

In working with Fig. C, note that A + C = a circle. B is a rectangle. To find the perimeter, add the circumference of AC and the 2 sides of B.

Fig. C

1. How long is the radius of A and C?
2. Find the area of AC.
3. Find the area of B.
4. Find the area of Fig. C.
5. How long is dimension D?
6. Find the perimeter of Fig. C.

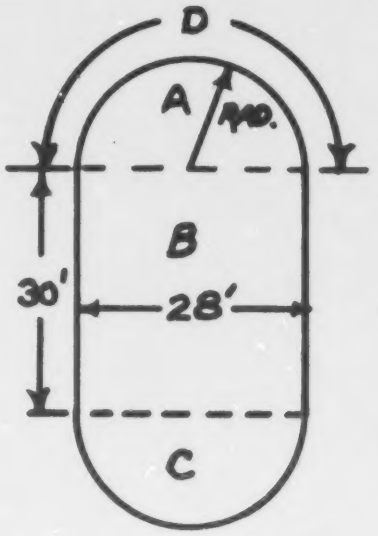


FIG. C

Fig. D

7. How long is dimension "X"?
8. Find the area of AB.
9. How long is dimension "Y"?
10. Find the area of BCD.
11. Find the area of Fig. D.
12. Find the perimeter of Fig. D.

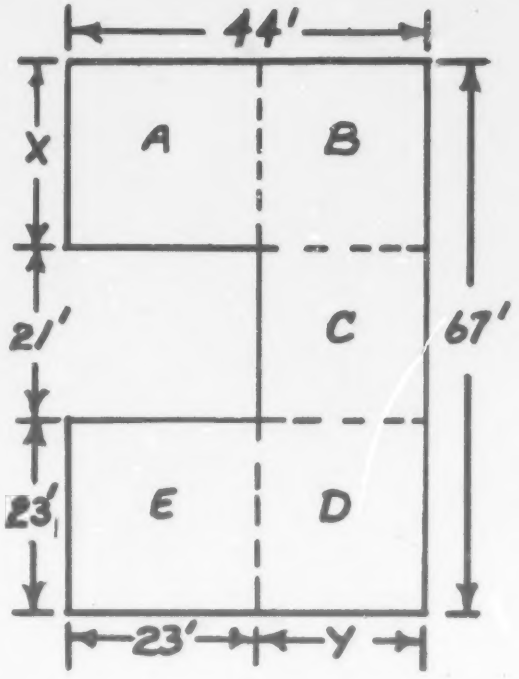


FIG. D

13. Add: $125' \frac{5}{8}" + 6\frac{1}{2}" + 8'\ 11\frac{7}{8}" + 9'\ 11" + 345'\ 7\frac{1}{4}"$
14. Multiply: 47' 8" X 39' 9" =
15. Divide: 36' 5" ÷ $5\frac{3}{4}$ =
16. It takes $6\frac{1}{2}$ brick to cover 1 sq. ft. of wall. How many brick are needed to cover a wall 288' long and 8' 8" high?
17. A builder erected a foundation for $27,650. Labor cost $10,928.55 and the overhead came to $2,826.50. Materials cost: 23 cu. yds. of concrete @ $31.00 per yard; 37,510 brick @ $142.50 per 1,000; 1,750 blocks @ 44¢ per block; 294 bags of mortar cement @ $2.85 per bag; and 32 tons of sand @ $5.85 per ton. How much did the builder make?
18. How many courses of brick are needed to build a wall 7' high? Brick are to be laid 4 courses in $10\frac{1}{2}"$.

90

OBJECTIVE: To learn how to find the area of the walls and ceiling of a room.

INFORMATION:

It is necessary to know how to find the area of the walls and ceiling of a room. A contractor may need this in estimating plasterboard, wallboard, wallpaper, ceiling tiles, paint, etc.

Square or rectangular rooms have four walls and a ceiling. You find the area of a wall just as you do for any other square or rectangle. For most estimating, nothing is deducted for the openings – the doors and windows. This allows for a little extra material in case of accident or waste.

Think! Anyone can develop a strong back, even a mule.

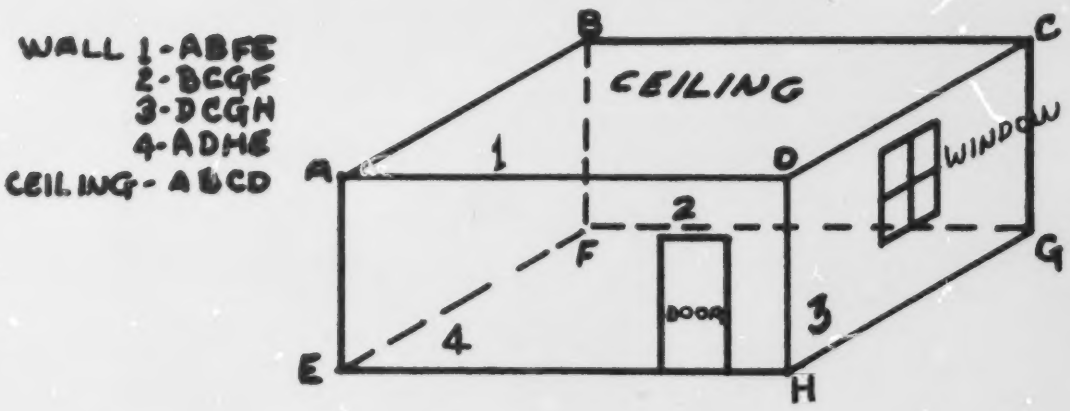
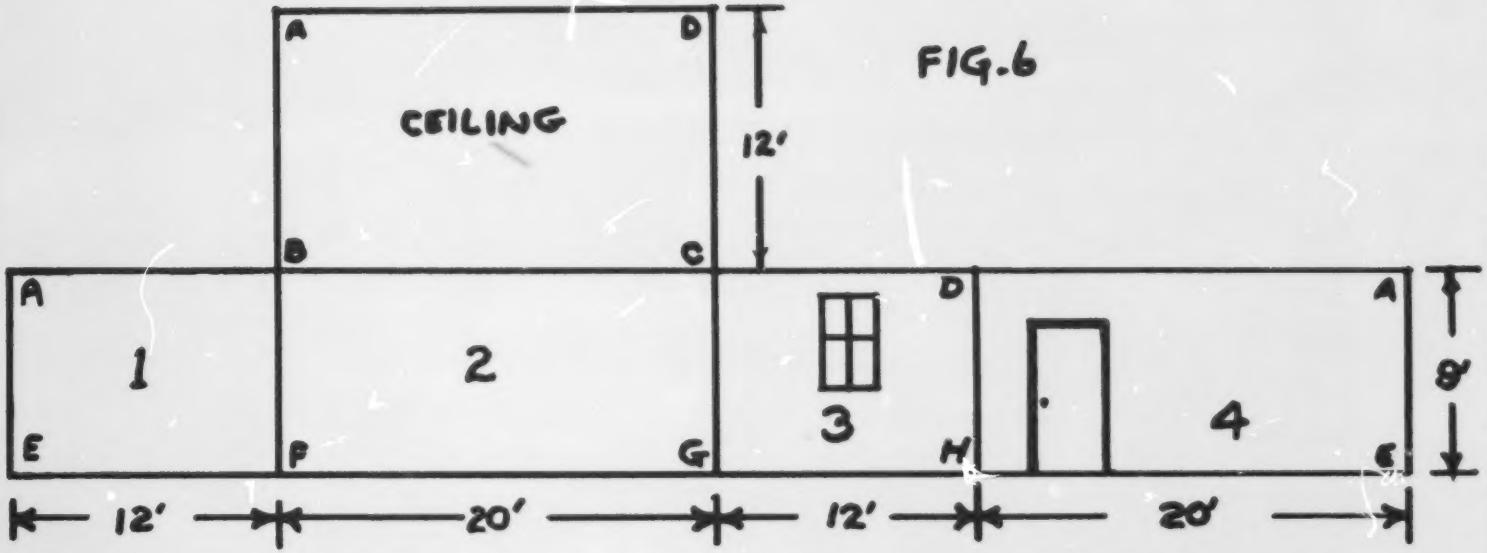


FIG. 5

Fig. 5 is a drawing of a room showing the walls and ceiling. In Fig. 6 we will take the walls and ceiling of a room apart and lay them out flat.



You can see that the area of the four walls is equal to the perimeter of the room times the height.

Perimeter = (2 X 12) + (2 X 20)

The area of the ceiling is equal to the length of the room times the width.

Area = 12 X 20

PROBLEM: How many sq. ft. in the walls and ceiling of a room 20′ long, 12′ wide, and 9′ high (dimensions of Fig. 6).

Fig. 6 shows that when you "flatten out" a room you will have 2 rectangular areas. One is the ceiling and the other is made up of the 4 walls.

First find the area of the ceiling by multiplying the length (20′) by the width (12′).

12′ × 20′ = 240 sq. ft., area of ceiling

All 4 walls are the same height, so instead of finding the area of each wall separately, add the lengths of the walls. (Wall 1 = 12′; wall 2 = 20′; wall 3 = 12′; wall 4 = 20′.)

12′ + 20′ + 12′ + 20′ = 64′, length of walls (perimeter of the room).

length (64′) × height (9′) = area of walls.

64′ × 9′ = 576 sq. ft., area of walls.

Add area of ceiling: + 240 sq. ft. area of ceiling.

816 sq. ft., total area of the walls and ceiling

Solving by calculator

It is probably quicker to add the length of the four walls individually than to try to multiply the length by 2 and the width by 2. After you get the area of the walls, put the figure into memory (or jot it down) before working out the area of the ceiling. Here is how you would do the above problem (area of walls first).

Press: [MC]	
Enter: 12, +, 20, +, 12, +, 20, =*	Display: 64.
Press: [X]	
Enter: 9, =	Display: 576.
Press: [M+]	Display: 576.m
Enter: 12, X, 20, =*	Display: 240.m
Press: [+], [MR], =	Display: 816.m

Answer: 816 sq. ft.

* It is not really necessary to press the = sign at this point, but you may feel more confident if you do.

Solve the problems in this assignment by following the instructions in Information Sheet No. 2. Think a little; it doesn't hurt.

Find the number of sq. ft. in the walls and ceilings of the rooms listed below:

	Length	Width	Height	Doors	Windows
1.	15′	12′	8′		
2.	29′	16′	8′ 6″		
3.	34′	19′	10′ 6″		
4.	22′ 6″	16′	9′		
5.	17′	12′ 6″	8′ 6″		
6.	21′	16′ 4″	9′		

7. Find the area of a circle whose diameter is 23′.

8. Find the area of a triangle whose base is 17′ and whose height is 14′.

9. Seven bricklayers worked 6 days, 7 hours per day and laid 32,046 brick. How many brick did each bricklayer average per hour?

10. Twelve bricklayers worked 14 days each, 7 hours per day and earned a total of $12,183.36. How much did each bricklayer earn per day?

11. A builder put up a foundation for $31,000. Labor cost was $10,127.65 and the overhead came to $2,869.75. Materials cost the following: 35 cu. yds. of concrete @ $29.90 per yard; 39,000 brick @ $158.00 per 1,000; 2,600 blocks @ $.45 each; 358 bags of mortar cement @ $2.95 per bag; 40 tons of sand @ $6.15 per ton; and door bucks and window frames for $867.50. How much profit did the builder make?

12. How much would a 24′ long I-beam, weighing $27\frac{1}{2}$ lbs. per lineal ft. cost, if each pound costs $.27?

13. How many courses of block are needed to build a wall 22′ $4\frac{1}{8}$″ high? The block courses are laid in $8\frac{1}{8}$″.

14. How many brick are needed for the first course of a foundation, 38′ 6″ long and 29′ 6″wide? A brick with the cross joint measures $8\frac{1}{2}$″.

Find the number of square feet in the walls and ceilings of rooms with the following dimensions:

	Length	Width	Height
1.	24′ 6″	18′	9′
2.	34′	21′	12′ 6″
3.	26′	19′	11′
4.	45′	21′	13′ 6″
5.	15′ 6″	12′	9′
6.	37′	22′	11′ 6″
7.	51′	26′	14′

8. Seventeen bricklayers worked 14 days, 7 hours per day and laid 148,274 brick. How many brick did each average per day?

9. How many square yards are there in a slab 25′ 6″ by 20′ 3″?

10. A builder put up the walls of a building for $34,500. Labor cost $13,425.50 and the overhead came to $2,998.49. Materials cost the following: 31 cu. yds. of concrete @ $32.50 per yard; 32,000 brick @ $157.00 per 1,000; 8,000 blocks @ 40.5¢ per block; 415 bags of mortar cement @ $2.87 per bag, 53 tons of sand @ $5.95 per ton; windows and door bucks for $929.89; and lintels for $288.70. How much profit did the builder make?

11. A builder bought 136 ft. of 4″ × 4″ × $\frac{3}{8}$″ angle-iron lintels. The angle iron weighed $7\frac{1}{2}$ lbs. per lineal foot, and cost 23¢ per lb. How much did the lintels cost?

12. It takes $6\frac{2}{3}$ brick laid with a $\frac{3}{8}$″ joint to face 1 sq. ft. of wall. How many brick are needed to face a wall 249′ long and 8′ 4″ high?

13. How many porcelain glazed tile will it take to face a wall 33′ 6″ long and 8′ high? Porcelain glazed tile cover $5\frac{1}{4}$″ × 8″ including the mortar joints.

14. How many 16″ long cinder blocks are needed to build a wall 38′ long and 12′ high? A 16″ block cover $\frac{8}{9}$ sq. ft. of wall, including the mortar joints.

How many square feet are in the walls and ceilings of rooms having the following dimensions?

	Length	Width	Height
1.	21′	16′	9′
2.	47′	33′	11′ 6″
3.	32′ 6″	24′	10′ 6″
4.	25′	17′	8′ 6″
5.	52′	27′ 6″	12′ 6″
6.	19′	17′	9′
7.	49′ 6″	28′	13′
8.	22′	17′ 6″	8′ 6″
9.	17′	13′	8′

10. Find the area of BCD.
11. Find the area of F.
12. Find the area of FED.
13. Find the area of the whole Fig. E.
14. Find the perimeter of Fig. E.

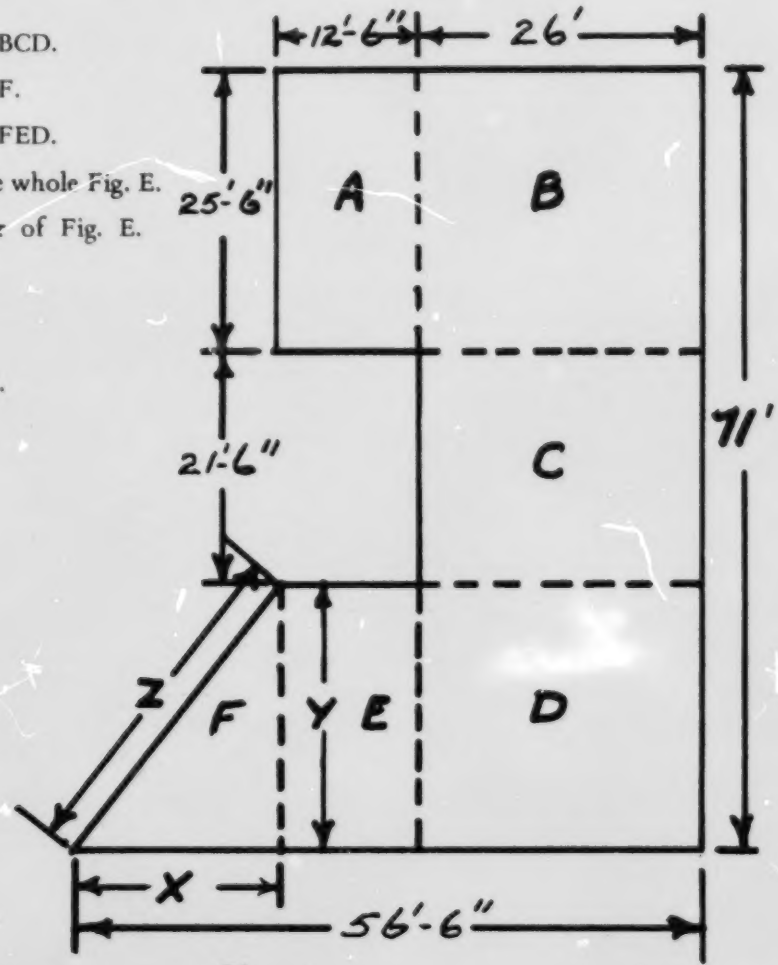


FIG. E

Next comes Test No. 7.

OBJECTIVE: To learn to find the surface area of a cube, rectangular prism, triangular prism, and cylinder.

INFORMATION:

1. To find the area of a cube:

   A cube has 6 sides, all of which are equal squares. See Fig. 8. To find the area, you multiply the length (3′) by the width (3′) by the 6 sides.

   3′ × 3′ × 6 = 54 sq. ft., area of Fig. 8.

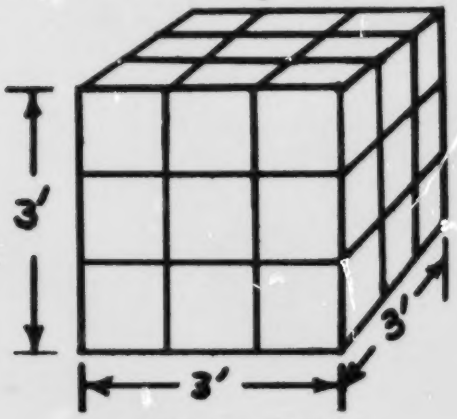


FIG. 8 – CUBE

2. To find the area of a rectangular prism (Fig. 9):

   A rectangular prism has six sides. The sides opposite each other have the same dimensions.

   Area of 2 sides (5′ × 10′) = 2 × 5′ × 10′ = 100 sq. ft.
   Area of 2 sides (4′ × 10′) = 2 × 4′ × 10′ = 80 sq. ft.
   Area of 2 sides (4′ × 5′) = 2 × 4′ × 5′ = 40 sq. ft.
   220 sq. ft., area of Fig. 9.

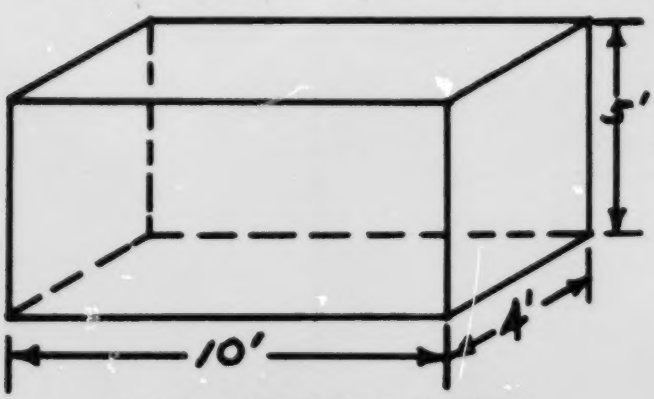
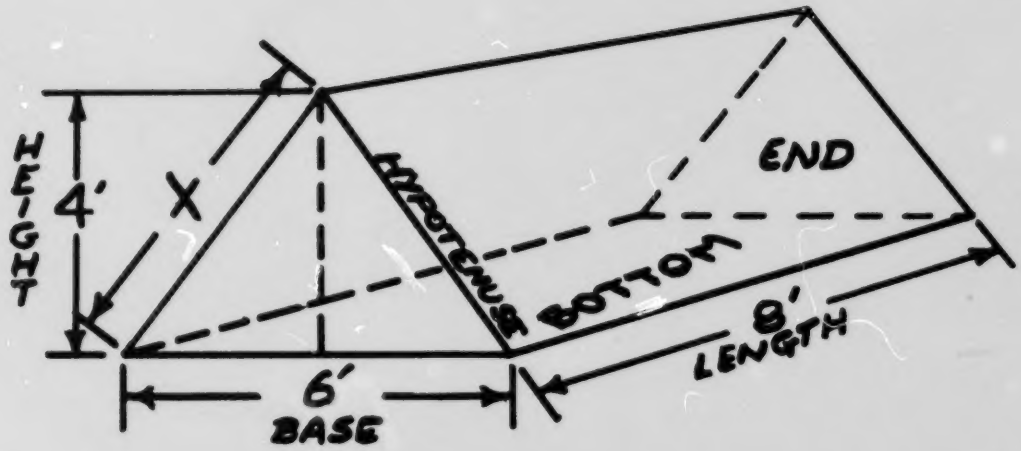


FIG. 9 – RECTANGULAR PRISM



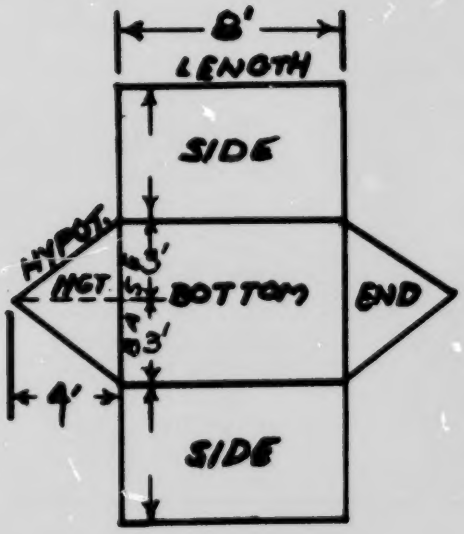


FIG. 10 – TRIANGULAR PRISM

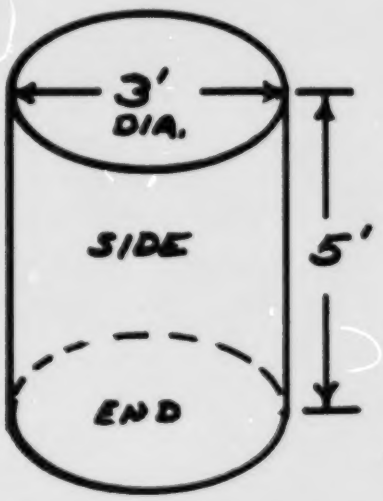
3. To find the area of a triangular prism (Fig. 10):

A triangular prism has 2 triangular ends, a bottom and 2 sides.

Before you can find the area of Fig. 10, you must find the length of dimension "x". The dash line denoting the height of the triangle divides the triangle into 2 equal halves. Each half is a right triangle. Using the 3-4-5 method you find dimension x = 5'.

Area of 2 ends = 2 X $\frac{1}{2}$' X 6' X 4' = 24 sq. ft.
Area of bottom = 6' X 8' = 48 sq. ft.
Area of sides = 2 X 5' X 8' = 80 sq. ft.
152 sq. ft., area of Fig. 10.

FIG. 11
CYLINDER



4. To find the area of a cylinder (Fig. 11):

A cylinder has 2 circular ends and 1 curved side which goes completely around it.

The cylinder ends in Fig. 11 have a radius of 1' 5".

Area of 2 circular ends = 2 X 1.5 X 1.5 X 3.1416 = 14.1372 sq. ft.

Circumference of an end = 3' X 3.1416 = 9.4248 ft.

Area of the curved side = circumference of the end X height
= 9.4248' X 5' = 47.1240 sq. ft.

Total area = 14.1372 sq. ft., area of ends
+47.1240 sq. ft., area of curved side
61.2612 sq. ft., total area or 61.3 sq. ft., rounded off

To summarize:

1. Area of a cube = 6 X area of a side

2. Area of a rectangular prism = 2 X area of 1 pair of opposite sides
   + 2 X area of 2nd pair of opposite sides
   + 2 X area of 3rd pair of opposite sides

3. Area of a triangular prism = 2 X area of triangular ends
   + area of bottom
   + 2 X area of sides

4. Area of a cylinder = 2 X area of circular ends
   + area of curved side (equal to perimeter of end X height)

Note: When working with decimals, keep three or four decimal places as you do the problem. Then round off your *answer* according to your need. Unless otherwise instructed, problems in area will be rounded off to a single decimal place.

For problems 1–9, draw a sketch to help you.

1. What is the area of a 7′ 4″ cube?
2. What is the area of a rectangular prism, 26′ 6″ long, 14′ high, and 9′ wide?
3. Find the area of a triangular prism whose base is 18′, height is 12′, and length is 19′ 6″.
4. Find the area of a cylinder whose diameter is 19′ and height is 23′.
5. Find the area of Fig. F.
6. Find the perimeter of Fig. F.

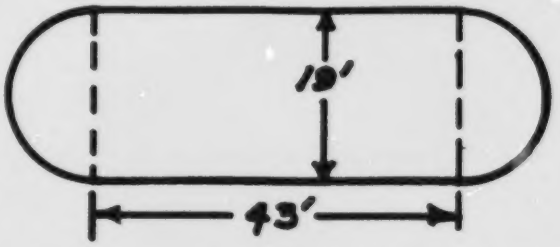


FIG. F

7. What is the area of a triangular prism whose base is 30′, height is 20′, and length is 26′ 8″?
8. Find the area of a circle whose diameter is 27′.
9. Find the area of a cylinder whose diameter is 24′ and height is 18′.

How many sq. ft. are there in the walls and ceilings of rooms having the following dimensions:

	Length	Width	Height
10.	38′	29′	12′
11.	22′	14′ 6″	9′ 6″

12. It takes $6\frac{1}{2}$ brick to face 1 sq. ft. of wall. How many brick are needed to face a wall 179′ 6″ long and 12′ high?
13. If each bricklayer lays 445 brick per day, how long will it take 7 bricklayers to lay 59,185 brick?

1. Find the area of a rectangular prism which is 21′ 6″ long, 14′ wide and 8′ high.
2. Find the area of a 9′ 6″ cube.
3. Find the area of a cylinder which is 9′ in diameter and 26′ high.
4. Find the area of a triangle whose base is 36′ and whose height is 27′.
5. Find the area of a circle 18′ in diameter.
6. Find the area of a triangular prism with a 12′ base, 8′ altitude, and 39′ length.
7. Find the area of Fig. G.
8. Find the perimeter of Fig. G.

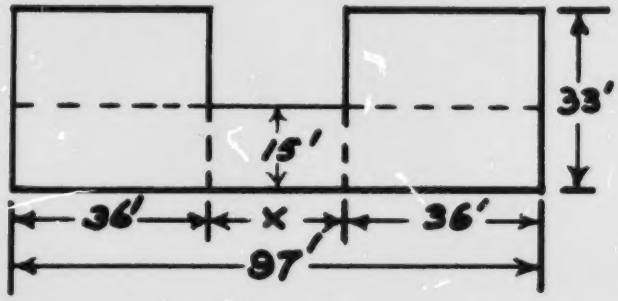


FIG. G

9. Find the area of Fig. H.
10. Find the perimeter of Fig. H.

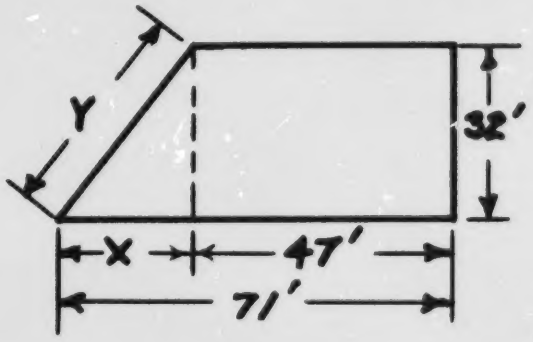


FIG. H

How many square feet are there in the walls and ceilings of the following rooms?

	Length	Width	Height
11.	49′ 6″	28′	13′
12.	22′	17′ 6″	8′ 6″
13.	17′	13′	8′

14. How long will it take 3 bricklayers to face a wall 324′ long and 7′ 6″ high? It takes $6\frac{1}{2}$ brick to face 1 sq. ft. of wall. Each bricklayer worked 7 hours per day and laid an average of 455 brick per day.

Volumes of Cubes, Rectangular Prisms, and Walls **Information Sheet No. 1**

OBJECTIVE: To learn how to compute the cubic contents of solid objects, including cubes, rectangular prisms, and walls.

INFORMATION:

A solid object or figure is one which has 3 dimensions, variously known as length, width or height, and thickness or width.

A wall is referred to as having length, height, and thickness or width. For example, a wall may be said to be 12" wide or 12" thick.

A solid block is referred to as having length, width and height.

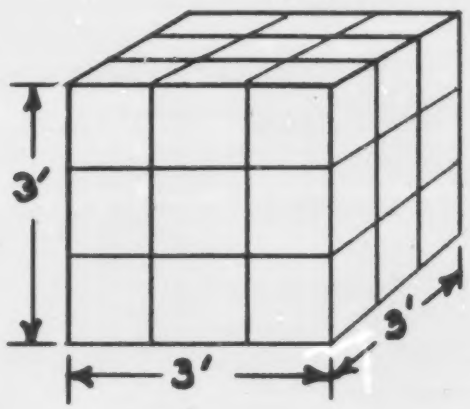


FIG. 12
CUBE

Cubic measure or **volume** tells how many cubic units of a certain size are needed to make a solid object. The units which you will be working with are cubic feet and cubic yards.

A cube is a solid object or figure which has all three dimensions the same length, for example, 3' long, 3' high, 3' wide.

Fig. 12 shows a cube which is 3' long, 3' high, and 3' wide. To find the cubic contents or volume of Fig. 12, you must multiply the length X the width X the height.

3' X 3' X 3' = 27 cubic feet

1. Find the area of a rectangular prism which is 33′ 6″ long, 9′ wide, and 12′ high.

2 Find the area of a 16′ 6″ cube.

3 Find the area of a cylinder which is 27′ high and has a 13′ diameter.

4. Find the area of right triangle whose base is 47′ and whose height is 35′.

5. Find the area of a circle which is 29′ in diameter.

6. Find the area of a triangular prism whose base is 18′, altitude is 12′, and length is 47′ 9″.

How many sq. ft. are there in the walls and ceilings of rooms having the following dimensions?

	Length	Width	Height
7.	32′ 6″	24′	10′ 6″
8.	49′ 6″	28′	13′

9. Find the area of Fig. I.

10. Find the perimeter of Fig. I.

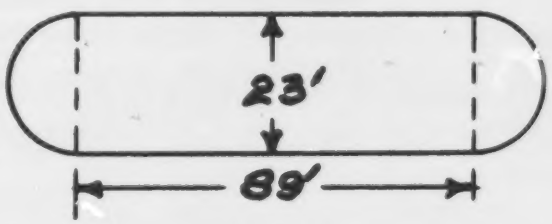


FIG. I

11. Deformed steel reinforcing rods cost $20\frac{1}{2}$¢ per lb. Deformed steel reinforcing rods $\frac{5}{8}$″ in diameter weigh 1.05 pounds per foot. How much will 1,989 lineal feet of $\frac{5}{8}$″ deformed steel reinforcing rods cost?

12. How long will it take 7 bricklayers to veneer a wall 343′ long and 9′ high? It takes 7 brick to veneer 1 sq. ft. of wall. Each bricklayer worked 7 hours per day and laid an average of 441 brick per day.

13. How many courses of brick are needed to build a wall 10′ $4\frac{7}{8}$″ high? The brick are to be laid 4 courses in $13\frac{1}{2}$″.

Now go on to Test #8.

To understand better why this is true, divide the height into 3 layers of 1′ each. Each layer is then divided into squares of 1′ each. The surface of each layer has 9 squares of 1′ each, so this gives you 9 one-foot cubes in the layer.

9 one-foot cubes in each layer multiplied by 3 layers = 27 one-foot cubes in a 3′ cube.

One yard is 3′ long, so a 3′ cube equals 1 cubic yard.

The unit of cubic measure used to estimate excavating, or buy concrete, sand, and gravel is the cubic yard. So remember that 1 cubic yard is made up of 27 cubic feet. The solid figures which are used most in building are the cube, rectangular prism, triangular prism, and the cylinder. The estimating which you will do will deal mainly with rectangular prisms.

The footings and walls of a building are actually a series of connected rectangular prisms.

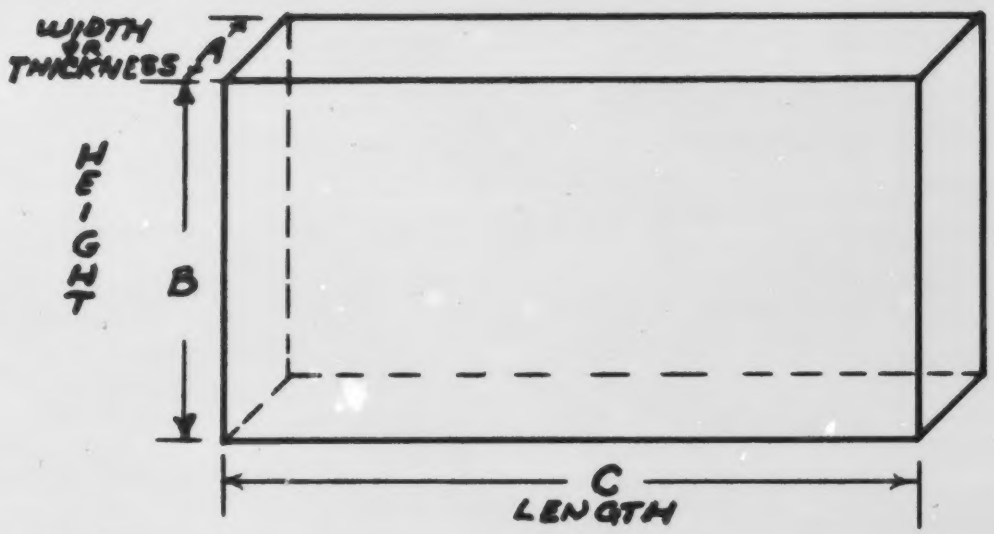


FIG. 13

To find the cubic contents or volume of Fig. 13, you do exactly as you did for Fig. 12.

Multiply:	Length X Height X (Width or Thickness).
Dimensions:	C X B X A

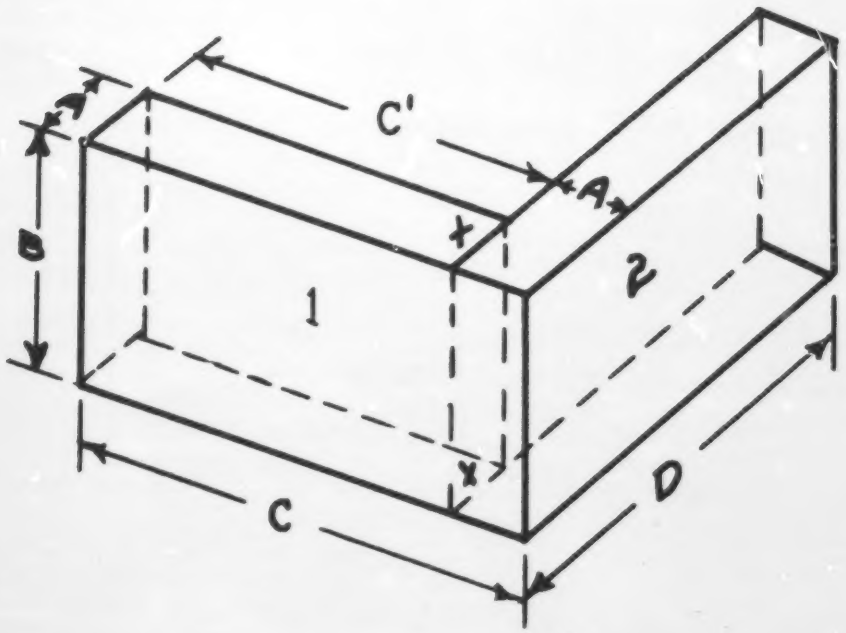


FIG. 14

Fig. 14 presents a different situation. On blueprints all dimensions for the outside walls of a building are given on the outside of the building. Fig. 14 is made up of 2 pieces of wall joined at right angles at point x - x. The length of piece 1 is C′. On a blueprint you will not be given the dimension shown as C′ in Fig. 14; instead you will be given dimension C. When you compare dimensions C and C′, it is easy to see that they are not the same length. Dimension C = C′ + A. Therefore, when you are taking your dimensions from a blueprint or sketch, you will add the dimensions and from this total you will subtract once the width of the wall (dimension A) for each corner. You can see that, if you did not subtract this width, when you multiplied the dimensions to get the cubic measure, you would be including the same corner twice. Therefore, for purposes of computing cubic measure, the length to be used in Fig. 14 is

C + D − A = LENGTH

To find the cubic contents, you do as you did for Fig. 12.

Multiply: Length X Height X Width

Let us give Fig. 14 numerical dimensions to better illustrate how you find the cubic contents.

Dimensions: A = 12", B = 4', C = 10', D = 8'.

First find the length: C + D − A. 10' + 8' − 1' = 17' LENGTH

Now multiply: Length X Height X Width. (Remember, you will get cubic feet.)

```
  17'   Length
X  4'   Height
  68    sq. ft.
X  1'   Width
  68    cubic feet
```

Divide the cubic feet by 27 to get cubic yards.

```
   2.51
27)68.00
   54
   140
   135
    50
```

2.5 cubic yards (rounded off) Ans.

Using the calculator

Be sure to get the length first. Then simply multiply by the other two dimensions. Do the above problem on the calculator to be sure you have the correct method.

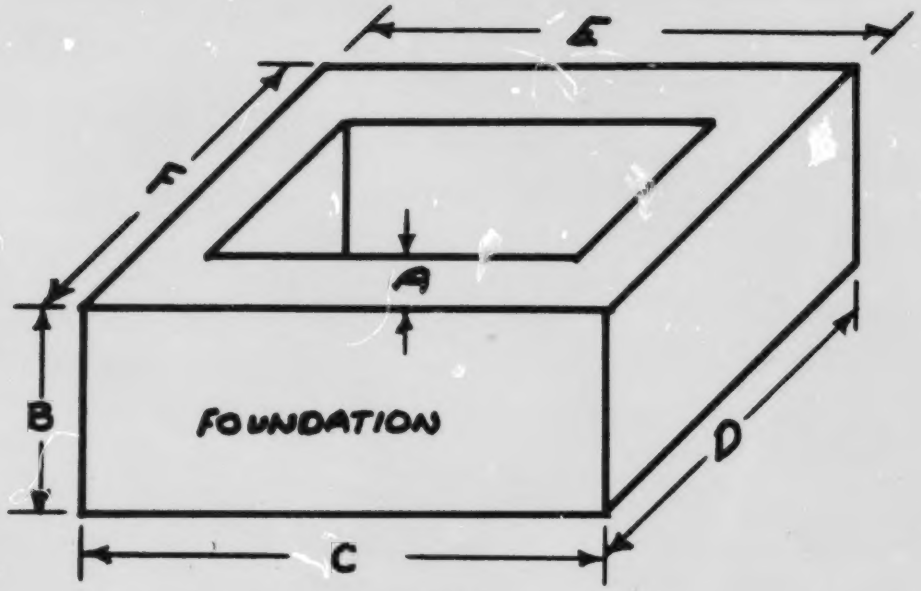


FIG. 15

Dimensions for Fig. 15: A = 12", B = 5', C = 16', D = 14', E = 16', F = 14'

To find the cubic contents of Fig. 15:

Find the length: C + D + E + F − (4 X A) = LENGTH

In Fig. 15 there are 4 corners and 4 sides. We have 4 sections of wall joined into one rectangular structure, so we must deduct the width of the wall once for each corner, or 4 times in all.

Add:	The dimensions of the 4 sides.	C	16'
		D	14'
		E	16'
		F	14'
			60' Perimeter
Subtract:	Once the width of the wall for each corner (4 X A)		− 4' Corners
			56' Length
Multiply:	Length X Height		X 5' Height
			280 sq. ft.
Multiply:	(Length X Height) X Width		X 1' Width
			280 cubic feet
Divide cubic feet by 27'			10.37
			27) 280.00
			27
			100
			81
			190
			189

Ans. 10.4 cubic yards, rounded off

The problems in this assignment are explained in Information Sheet No. 1. Check each problem to find out whether it refers to Fig. 12, 13, 14, or 15. Work carefully. Do not go ahead with your work unless you are certain that the work is being done correctly.

The estimating which you will do later is based on what you are learning to do now. Learning the right way now will save time and trouble later.

Estimating is a way of figuring out the amount of materials needed. You cannot afford to guess. *Your estimate must be accurate.*

Using the calculator

In using a calculator for chain multiplication and division, the machine always operates on *the number in the display.* You cannot stop in the middle of a problem to subtract something like (4×16″). Therefore you either do this part first and put the result into memory, or work it out (4×1$\frac{1}{3}$) with pencil and paper when you come to it.

Before dividing by 27 in the following problems, be sure to *write down* the number of *cubic feet.* That way you will be able to use the figure later for estimating brick, or whatever you need.

PROBLEMS: How many cu. yds. are in the following walls?

	A	B	C	D	E	F
1. (Fig. 13)	12″	10′	46′			
2. (Fig. 15)	12″	9′	23′	47′	23′	47′
3. (Fig. 14)	12″	6′	42′	63′		
4.	16″	12′	46′	65′	46′	65′
5.	16″	11′	55′			
6.	8″	8′	73′			
7.	12″	9′	21′	27′	21′	27′
8.	9″	12′	45′ 4″	48′ 5″		
9.	16″	15′	38′ 8″	45′	38′ 8″	45′
10.	9″	12′	39′	60′	39′	60′

How many sq. ft. are in the walls and ceilings of the following rooms?

	Length	Width	Height
11.	52′	36′ 6″	14′ 6″
12.	77′ 6″	29′	16′ 9″

13. Three-quarter-inch round deformed reinforcing steel weighs 1.52 lbs. per lineal foot and costs $9\frac{3}{4}$¢ per lb. How much will 2,747 lineal feet cost?

14. It takes 19 brick laid with a $\frac{1}{2}$″ mortar joint to build 1 cu. ft. of wall. How many brick are needed to build a wall 75′ 8″ long, 8′ high, and 12″ wide?

15. How long will it take 3 bricklayers to lay the brick in problem 14, if they lay an average of 426 brick each per day?

How many cu. yds. are there in the following walls and prisms?
(Be sure to keep track of the number of cubic feet in each problem before changing it to cubic yards.)

		A	B	C	D	E	F
1.	(Fig. 13)	9′	6′	47′			
2.		12″	18′	57′			
3.	(Fig. 15)	18″	16′	39′	66′	39′	66′
4.		16″	15′	38′ 8″	45′	38′ 8″	45′
5.	(Fig. 13)	9″	12′	36′			
6.		11′	4′ 6″	38′			
7.	(Fig. 15)	12″	9′	75′	56′	75′	56′
8.		18″	12′	28′	36′ 6″	28′	36′ 6″
9.	(Fig. 14)	18″	8′	40′	75′ 6″		
10.	(Fig. 13)	11″	11′	11′			

11. It takes $6\frac{2}{3}$ brick to veneer 1 sq. ft. of wall. How many brick are needed to veneer a wall 162′ 8″ long and 9′ 6″ high?

12. It takes 19 brick laid with a $\frac{1}{2}$″ mortar joint to build 1 cu. ft. of wall. How many brick are needed to build a wall 199′ 8″ long, 9′ 6″ high, and 12″ wide?

13. It takes 15 cu. ft. of mortar to lay 1,000 brick with a $\frac{1}{2}$″ mortar joint. How many cu. yds. of mortar are needed to lay the brick in problem 12?

How many sq. ft. are there in the walls and ceilings of the following rooms?

	Length	Width	Height
14.	48′	33′ 6″	13′
15.	21′ 6″	18′	10′

16. $5\frac{2}{3}\%$ of 17,988 = ?

17. How many courses of brick are needed to build a wall 9′ $9\frac{7}{8}$″ high? The brick are to be laid 4 courses in $11\frac{1}{2}$″.

How many sq. ft. are there in the walls and ceilings of the following rooms?

	Length	Width	Height
1.	89′ 6″	46′	17′ 6″
2.	27′ 6″	23′ 6″	9′ 9″

How many cu. yds. are there in the following foundation walls?

	A	B	C	D	E	F
3.	12″	10′ 6″	43′			
4.	16″	11′ 6″	57′			
5.	9″	9′	37′ 4″			
6.	12″	11′ 6″	55′	47′ 6″	55′	47′ 6″
7.	16″	13′ 6″	47′ 4″	33′ 4″	47′ 4″	33′ 4″
8.	8″	7′ 8″	32′ 6″	28′	32′ 6″	28′

9. It takes 20 brick laid with a $\frac{3}{8}$″ mortar joint to build 1 cu. ft. of wall. How many brick are needed to build a wall 77′ 6″ long, 9′ high, and 12″ wide?

10. It takes 19 brick laid with a $\frac{1}{2}$″ mortar joint to build 1 cu. ft. of wall. How many brick are needed to build a wall 98′ long, 6′ 6″ high, and 8″ wide?

11. It takes $13\frac{1}{2}$ cu. ft. of mortar to lay 1,000 brick with a $\frac{3}{8}$″ mortar joint. How many cubic yards of mortar are needed to lay the brick in problem 9?

12. If a bricklayer averages 450 brick per day, how many working days will it take to build the wall in problem 9?

13. Three-eighths-inch deformed round reinforcing steel weighs .38 lbs. per lineal foot. Find the cost of 5,690 feet at 21¢ per lb.

14. It takes 1 cu. yd. of sand and 9 cu. ft. of cement paste or lime putty to make 1 cu. yd. of mortar. How much sand must you buy to make the mortar needed in problem 11?

15. Find the area of a cylinder whose diameter is 37′, and whose height is 18′.

1. Find the area of a circle whose circumference is 53.4′.

How many sq. ft. are there in the walls and ceilings of the following rooms?

	Length	Width	Height
2.	18′	12′	8′ 6″
3.	28′	13′ 6″	9′

How many cu. yds. are there in the following foundations?

	A	B	C	D	E	F
4.	18″	18′	54′			
5.	16″	15′	63′			
6.	18″	12′	48′	54′	48′	54′
7.	12″	9′	39′	43′	39′	43′
8.	16″	15′	38′ 8″	45′	38′ 8″	45′
9.	9″	12′	39′	60′	39′	60′
10.	9″	18′	27′	75′ 6″		
11.	17′	4′ 6″	39′			

12. It takes 20 brick laid with a $\frac{3}{8}$″ mortar joint to build 1 cu. ft. of wall. How many brick are needed to build a wall 164′ long, 9′ high, and 12″ wide?

13. It takes 19 brick laid with a $\frac{1}{2}$″ mortar joint to build 1 cu. ft. of wall. How many brick are needed to build a wall 259′ 6″ long, 7′ 6″ high, and 16″ wide?

14. I-beams cost 23¢ per lb. Find the cost of an I-beam 27′ 6″ long, weighing 33 lbs. per foot.

15. Find the area of a triangular prism whose base is 18′, whose height is 12′, and whose length is 47′ 6″.

16 $16\frac{2}{3}\%$ of 49,305 = ?

How many sq. ft. are there in the walls and ceilings of the following rooms?

	Length	Width	Height
1.	71′	46′	15′ 6″
2.	47′ 6″	54′	16′

How many cu. yds. are there in the following foundations?

	A	B	C	D	E	F
3.	18″	12′	37′ 6″	55′ 6″	37′ 6″	55′ 6″
4.	12″	15′	49′ 6″	43′ 6″	49′ 6″	43′ 6″
5.	16″	15′	38′ 8″	45′	38′ 8″	45′
6.	9″	18′	36′	42′	36′	42′
7.	8″	13′ 6″	47′ 6″	38′	47′ 6″	38′
8.	35′	2′ 8″	48′			
9.	9″	11′ 6″	56′			

10. It takes 19 brick laid with a $\frac{1}{2}$″ mortar joint to build 1 cu. ft. of wall. How many brick are needed to build a wall 93′ long, 9′ 6″ high, and 12″ wide?

11. It takes 20 brick laid with a $\frac{3}{8}$″ mortar joint to build 1 cu. ft. of wall. How many brick are needed to build a wall 156′ 6″ long, 12′ high, and 16″ wide?

12. It take $13\frac{1}{2}$ cu. ft. of mortar to lay 1,000 brick with a $\frac{3}{8}$″ mortar joint. How many cu. yds. of mortar are needed to lay the brick in problem 11?

13. Ten bricklayers working 7 hours per day, laid an average of 626 brick each per day. How long will it take them to lay the brick in problem 11?

14. $5\frac{2}{3}\%$ of 50,080 = ?

15. Find the area of Fig. A.

16. Find the perimeter of Fig. A.

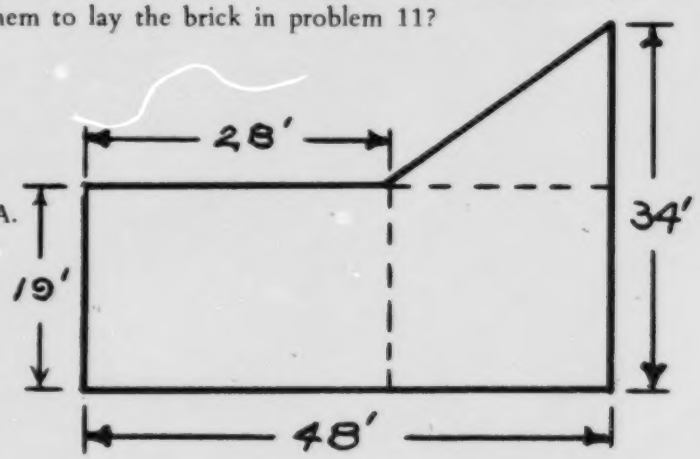


FIG. A

OBJECTIVE: To learn how to find the amounts of brick, mortar, and stone to build or veneer walls.

INFORMATION:

The following table will provide the information needed to estimate the amounts of materials needed to build walls. Remember, if you think first, you will save time and trouble.

Number of Brick Needed to Build 1 Cu. Ft. of Wall				
Size of Mortar Joint	$\frac{1}{4}$"	$\frac{3}{8}$"	$\frac{1}{2}$"	$\frac{5}{8}$"
Number of Brick Needed	21	20	19	$18\frac{1}{4}$

Amount of Mortar Needed to Lay 1000 Brick				
Size of Mortar Joint	$\frac{1}{4}$"	$\frac{3}{8}$"	$\frac{1}{2}$"	$\frac{5}{8}$"
Amount of Mortar Needed	9 cu. ft.	$13\frac{1}{2}$ cu. ft.	15 cu. ft.	18 cu. ft.

One Ton of Marble Veneer Covers 40 Sq. Ft. of Wall.

One Ton of Grained Stone Veneer Covers 44 Sq. Ft. of Wall.

To find the number of brick needed to build a wall:

First find the number of cu. ft. in the wall and label your work. Then multiply the number of cu. ft. of wall by the number of brick which are needed to build 1 cu. ft. of wall, using a certain size mortar joint.

Let us work it out in a problem. How many brick are needed to build a wall 15′ long, 8′ high, and 12″ wide, using a $\frac{3}{8}$″ mortar joint?

Find the cu. ft. in the wall. Length × Height × Width. The table shows that it takes **20** brick laid with a $\frac{3}{8}$″ mortar joint to build 1 cu. ft. of wall.

15′	Length
× 8′	Height
120	sq. ft.
× 1′	Width
120	cu. ft. of wall

Therefore you multiply 120 cu. ft. of wall × 20 brick (in 1 cu. ft.)

120	cu. ft. of wall
× 20	brick per cu. ft.
2400	**brick needed**

To find the amount of mortar needed to lay the brick, you check the table and find that, with a $\frac{3}{8}$″ mortar joint, you need $13\frac{1}{2}$ cu. ft. of mortar to lay 1,000 brick. So, divide the total number of brick into units of 1,000 brick each. To do this you start from the right and point off 3 decimal places.

2.400
/ decimal point

You now have 2.4 units of 1,000 brick each. Multiply the number of units of 1,000 brick each by the amount of mortar needed to lay 1,000 brick with a $\frac{3}{8}$″ mortar joint.

2.4	units of 1,000 brick
× $13\frac{1}{2}$	cu. ft. of mortar needed to lay 1,000 brick
12	
72	
24	
32.4	cu. ft. of mortar needed.

Always give the quantity of mortar in cu. yds. Divide 32.4 cu. ft. by 27.

1.2 cu. yds. of mortar needed

27) 32.4
27
54
54

ANS. 2,400 brick
1.2 cu. yds. mortar

Stone veneer: To find the number of tons of stone veneer needed to veneer a house.

First find the number of sq. ft. of surface on the outside of the house.

Sq. ft. of surface = **perimeter × height.**

Then divide the sq. ft. of surface by the number of sq. ft. of wall covered by 1 ton of stone veneer.

Follow the instruction in Information Sheet No. 2.

The work is not new; it is just being given you in a different way. You should have no trouble using chain multiplication on the new types of problems, but be sure to write down the number of *cubic feet* in the "foundation" problems so you can use the figure later.

How many sq. ft. are there in the walls and ceilings of the rooms with the following dimensions?

	Length	Width	Height
1.	64′ 6″	42′	15′
2.	33′	25′ 4″	14′ 6″

How many cu. yds. are there in foundation walls having the following dimensions?

	A	B	C	D	E	F
3.	18″	18′	54′			
4.	16′	15′	63′			
5.	8″	15′	38′ 8″	45′	38′ 8″	45′
6.	12″	12′	42′	42′	42′	42′
7.	8″	9′	39′	43′	39′	43′
8.	16″	15′	60′	74′ 8″	60′	74′ 8″

9. It takes 1 ton of marble to veneer 40 sq. ft. of wall. Find the amount of marble needed to veneer a wall 192′ long and 9′ 8″ high.

10. How many brick laid with a $\frac{3}{8}$″ mortar joint are needed for the foundation walls in problem 5?

11. How many brick laid with a $\frac{1}{2}$″ mortar joint are needed for the foundation walls in problem 6?

12. How many cu. yds. of mortar are needed to lay the brick in problem 10?

13. How may cu. yds. of mortar are needed to lay the brick in problem 11?

14. How long will it take 8 bricklayers, working 7 hours per day, to lay the brick in problem 11 if the bricklayers average $389\frac{1}{2}$ brick per day?

1. Find the number of sq. ft. in the walls and ceilings of a room 31′ long, 29′ wide, and 12′ high.

How many cu. yds. are there in foundation walls having the following dimensions?

	A	B	C	D	E	F
2.	16″	12′	42′	42′	42′	42′
3.	12″	13′ 6″	50′	38′	50′	38′
4.	8″	12′	39′	60′	39′	60′
5.	16″	18′	36′	42′	36′	42′
6.	8″	15′	48′ 6″	68′ 6″	48′ 6″	68′ 6″

7. How may brick laid with a $\frac{3}{8}$″ mortar joint are needed for the foundation walls in problem #2?

8. How may brick laid with a $\frac{1}{2}$″ mortar joint are needed for the foundation walls in problem #5?

9. How many cu. yds. of mortar are needed to lay the brick in problem #8?

10. How many cu. yds. of mortar are needed to lay the brick in problem #7?

11. How many tons of grained veneer stone are needed to face a house 48′ 6″ long, 28′ 3″ wide, and 9′ high?

12. Find the area of a triangular prism whose base is 36′, whose height is 24′, and whose length is 58′ 6″.

13. How many cu. yds. of earth must be dug from an excavation which is 87′ 6″ long, 38′ wide, and 7′ 4″ deep?

14. Find the cost of 4,650′ of $\frac{1}{2}$″ round, deformed reinforcing steel. Round, deformed reinforcing steel weighs .66 lbs. per foot and costs 17.7¢ per lb.

15. $5\frac{2}{3}\%$ of 52,054 = ?

16. $16\frac{2}{3}\%$ of 68,704 = ?

OBJECTIVE: To learn how to find the number of cu. yds. in a footing.

INFORMATION:

Because the footings of a building are the base which supports the building, the footing is almost always wider than the foundation wall. On a blueprint, the length and width of a building are given on the outside of the foundation, but very rarely on the outside of a footing.

Figures 17 and 18, on the following page, show the dimensions necessary to compute a footing. The dimensions given are the width of the footing, A, and the height or depth, B. You use the same **length** to estimate **both** the **footing** and the foundation. To find the cu. yds. in a **footing**, you multiply the Length X Width X Height, just as you do to find the cu. yds. in a wall.

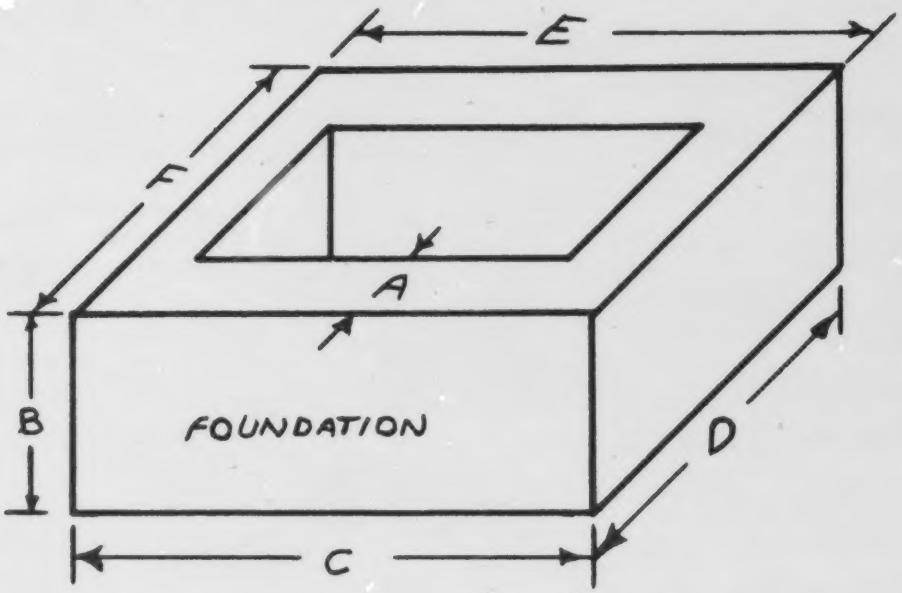


FIG. 16

FIG. 17

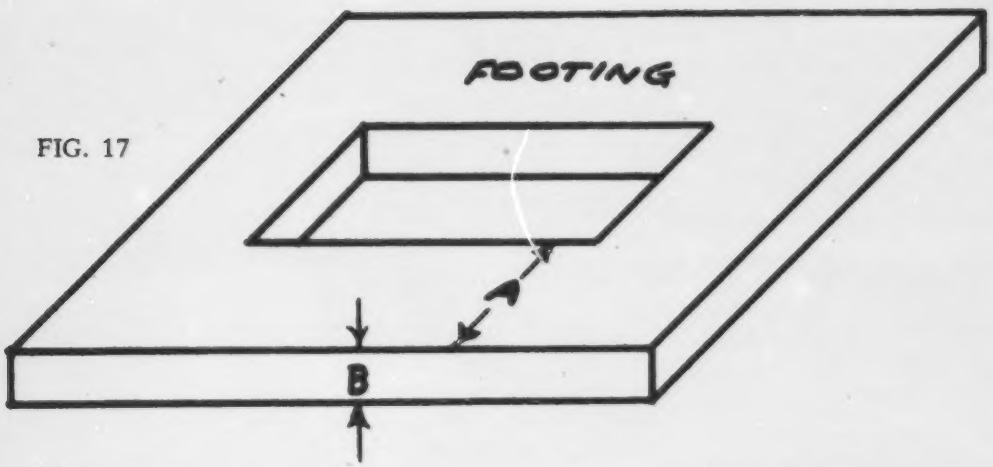
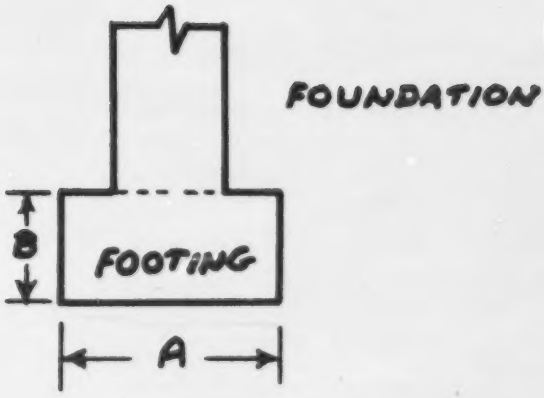


FIG. 18



Follow the instructions on Information Sheet No. 3. Read each problem carefully to see whether the answer is required for the foundation only, footing only, or foundation and footing combined.

1. How many sq. ft. are there in the walls and ceiling of a room which is 38′ long, 29′ wide, and 12′ high?

How many cu. yds. are there in the footings and foundation walls having the following dimensions? (Keep track of the number of cubic feet!)

	A	B	C	D	E	F	
2.	12″	9′	34′	37′	34′	37′	Foundation
3.	12″	9′	75′	56′	75′	56′	Foundation
4.	2′	1′	Footing for foundation in problem 2				
5.	2′	1′	Footing for foundation in problem 3				
6.	16″ 2′ 6″	15′ 1′ 4″	60′	74′ 8″	60′	74′ 8″	Foundation and Footing
7.	12″ 2′	9′ 1′	37′	34′	37′	34′	Foundation and Footing

8. How many brick laid with a $\frac{3}{8}$″ mortar joint are needed for the foundation walls in problem 2?

9. How many brick laid with a $\frac{1}{2}$″ mortar joint are needed for the foundation walls in problem 3?

10. How many cu. yds. of mortar are needed to lay the brick in problem 8?

11. How many cu. yds. of mortar are needed to lay the brick in problem 9?

12. How many working hours will it take to lay the brick in problem 9, if the bricklayers work 7 hours per day and average 378 brick per day?

13. How many tons of grained stone are needed to veneer a house 48′ 8″ long, 26′ 4″ wide, and 9′ 8″ high?

14. $5\frac{2}{3}\%$ of 44,118 = ?

How many cu. yds. are there in the footings and foundation walls having the following dimensions?

	A	B	C	D	E	F
1.	12″ 2′	13′ 6″ 1′	50′	38′	50′	38′
2.	15″	12′	38′ 6″	48′	38′ 6″	48′
3.	16″ 2′ 8″	15′ 1′ 4″	60′	74′ 8″	60′	74′ 8″
4.	16″ 2′ 8″	9′ 1′ 4″	45′ 2″	39′ 6″	45′ 2″	39′ 6″
5.	12″ 2′	9′ 1′	45′	39′	45′	39′
6.	18″	12′	42′	63′	42′	63′

7. How many sq. ft. are there in the walls and ceiling of a room 31′ long, 27′ wide, and 10′ 6″ high?

8. How many brick laid with a $\frac{1}{2}$″ mortar joint are needed for the foundation walls in problem 1?

9. How many brick laid with a $\frac{3}{8}$″ mortar joint are needed for the foundation walls in problem 5?

10. How many cu. yds. of mortar are needed to lay the brick in problem 8?

11. How many cu. yds. of mortar are needed to lay the brick in problem 9?

12. How many tons of marble are needed to veneer a house 47′ 8″ long, 33′ 6″ wide, and 9′ 6″ high?

13. $16\frac{2}{3}\%$ of 29,520 = ?

14. Five-eighths-inch round, deformed reinforcing steel weighs 1.05 lbs. per foot and costs $.19 per lb. Find the cost of 3,985 feet of round deformed reinforcing steel.

How many cu. yds. are there in the following footings and foundation walls?

	A	B	C	D	E	F
1.	16″ / 2′ 8″	12′ 6″ / 1′ 4″	41′	57′	41′	57′
2.	8′	5′	169′			
3.	12″	13′	39′	43′ 6″	39′	43′ 6″
4.	16″ / 2′ 8″	12′ / 1′ 4″	38′ 8″	45′	38′ 8″	45′
5.	15″ / 2′ 6″	12′ / 1′ 3″	50′ 6″	45′	50′ 6″	45′

6. How many brick laid with a $\frac{5}{8}$″ mortar joint are needed for the foundation walls in problem 1?

7. How many brick laid with a $\frac{3}{8}$″ mortar joint are needed for the foundation walls in problem 3?

8. How many cu. yds. of mortar are needed to lay the brick in problem 6?

9. How many cu. yds. of mortar are needed to lay the brick in problem 7?

10. How many sq. ft. are there in the walls and ceiling of a room 41′ long, 32′ wide, and 12′ 6″ high?

11. How many working days will it take to lay the brick in problem 7 if the bricklayers lay an average of 520 brick each per day?

12. $5\frac{2}{3}\%$ of 57,995 = ?

13. Find the area of a rectangular prism 26′ 6″ long, 14′ 6″ wide, and 9′ high.

14. Find the area of a cylinder 19′ high, which has a diameter of 19′.

15. How many tons of grained veneer stone are needed for the foundation in problem 3?

How many cu. yds. are there in the following footings and foundation walls?

	A	B	C	D	E	F
1.	9′ 6″	5′	189′			
2.	12″ 2′	13′ 6″ 1′	27′	38′	27′	38′
3.	16″	12′	27′ 2″	49′	27′ 2″	49′
4.	12″ 2′	9′ 1′	34′	37′	34′	37′
5.	18″ 3′	12′ 1′ 6″	29′	42′	29′	42′
6.	8″ 1′ 4″	9′ 8″	78′ 4″	47′ 6″	78′ 4″	47′ 6″

7. How many brick laid with a $\frac{1}{4}$″ mortar joint are needed for the foundation walls in problem 6?

8. How many brick laid with a $\frac{1}{2}$″ mortar joint are needed for the foundation walls in problem 3?

9. How many cu. yds. of mortar are needed to lay the brick in problem 7?

10. How many cu. yds. of mortar are needed to lay the brick in problem 8?

11. How many sq. ft. are there in the walls and ceiling of a room 29′ 6″ long, 24′ wide, and 11′ 6″ high?

12. Find the area of a triangular prism whose base is 28′, whose height is 17′, whose sides are 21′, and whose length is 46′ 6″.

13. Find the area of Fig. A.

14. Find the perimeter of Fig. A.

15. $16\frac{2}{3}\%$ of 44,688 = ?

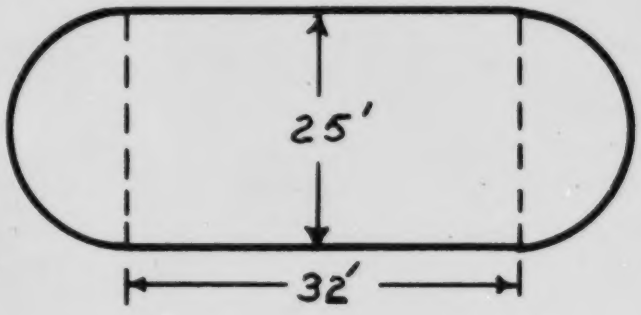


FIG. A

Now go on to Test No. 9.

OBJECTIVE: To learn how to find the cubic contents of cylinders and triangular prisms.

INFORMATION:

In construction today, many round columns of concrete are used. Also many concrete walls have slanting sides. In the assignments which follow you will learn how to compute the cubic contents (volume) of both cylinders and triangular prisms.

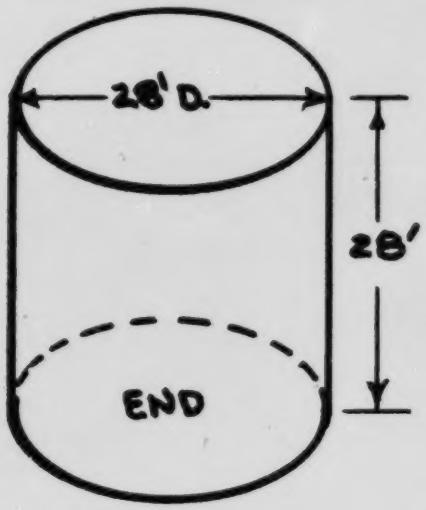


FIG. 19 CYLINDER

Fig. 19 is a round column or cylinder. To find the number of cu. yds. in Fig. 19:

First, you must find the area of one of the circular ends (either the top or the bottom). To find the area of a circle, you recall, you multiply the radius X radius X 3.1416.

The radius is $\frac{1}{2}$ of the diameter.
$\frac{1}{2} \times 28' = 14'$

radius 14'
radius X 14'
196 sq. ft.

3.1416
X 196 sq. ft.
615.7536 sq. ft., area of the end of Fig. 19.

Next, you multiply the area of the end of Fig. 19 by the height. You now have the number of cubic feet in Fig. 19.

615.7536 sq. ft. area
X 28 ft. high
17,241.1008 cu. ft. in Fig. 19.

Divide by 27 to get cubic yards.

638.5592
27) 17,241.1008

= 638.6 cu. yds. in Fig. 19. ANS.

Summarizing, to find the cubic contents of a cylinder, multiply the **area of the end** X **height**.

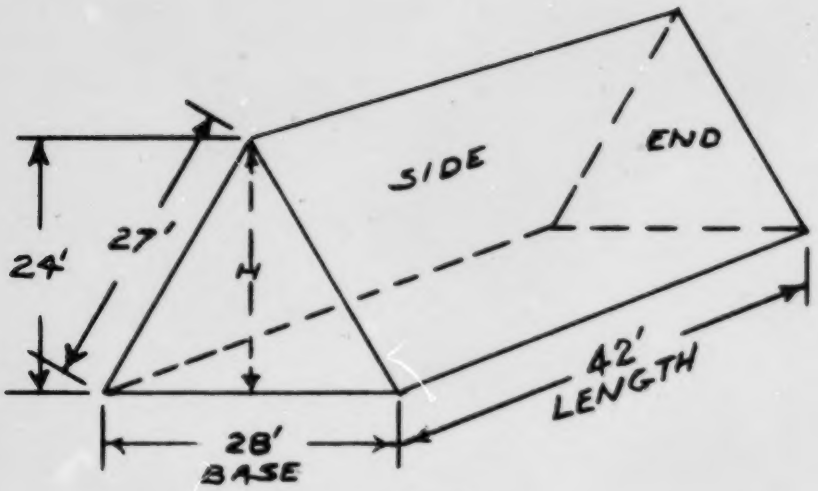


Fig. 20
TRIANGULAR PRISM

Fig. 20 is a triangular prism. To find the number of cubic yards in Fig. 20:

First, you must find the area of one end. To find the area of one end, which is a triangle, we multiply:

$\frac{1}{2}$ base X the height

$\frac{1}{2} \times 28' = 14'$

$\frac{1}{2}$ base 14'
X height X 24'
336 sq. ft., area of end of Fig. 20

Next, multiply the area of the end of Fig. 20 by the length.

336 sq. ft. area of end of Fig. 20
X 42' length
14,112 cubic feet in Fig. 20

Divide by 27 to get cubic yards.

$27\overline{)14112}$ = 522.666 cu. yds. in Fig. 20

522.7 cu. yds. ANS.

Summarizing, to find the cubic contents of a triangular prism, multiply the area of the end X length.

Give your answers to the volume problems correct to one decimal place.

1. Find the number of cu. yds. in a cylinder which has a diameter of 11′ and which is 17′ high.

2. Find the number of cu. yds. in a triangular prism which has a base of 15′, sides 18′, height 12′, and which is 27′ 6″ long.

3. Find the number of cu. yds. in a cylinder whose radius is 15′ and whose height is 23′.

4. Find the number of cu. yds. in a triangular prism whose base is 18′, whose height is 12′, and whose length is 27′ 9″.

5. Find the area of a cylinder which is 4′ in diameter and 18′ high.

6. Find the number of cubic yards in a column whose circumference is 10.2 ft. and whose height is 29′ 9″.

7. Find the area of a triangular prism which has a base 12′ wide, whose sides are 10′, whose height is 8′, and which is 25′ 4″ long.

8. Find the number of cu. yds. in a triangular prism whose base is 9′, height is 6′, and length is 18′ 6″.

9. Find the number of cu. yds. in a column 3′ in diameter and 19′ 6″ high.

10. How many cu. yds. are there in the following footing and foundation walls?

A	B	C	D	E	F
12″ / 2′	9′ 6″ / 1′	32′ 2″	47′ 4″	32′ 2″	47′ 4″

11. How many brick laid with a $\frac{5}{8}$″ mortar joint are needed for the foundation walls in problem 10?

12. How many cu. yds. of mortar are needed to lay the brick in problem 11?

13. $16\frac{2}{3}\%$ of 26,670 = ?

14. How many cu. yds. are there in a slanted wall (section view) Fig. A, which is 57′ long.

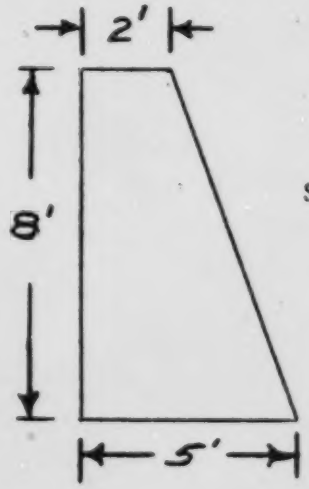


Fig. A
Section View

1. Find the number of cu. yds. in 12 columns, each of which has a diameter of 3′ and a height of 18′.

2. How many cu. yds. are there in a triangular prism (section view, Fig. A) whose length is 19′ 6″?

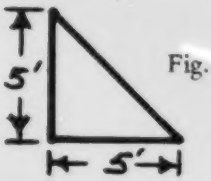


Fig. A Section View

3. How many cu. yds. are there in a slanted wall (section view, Fig. B) whose length is 88′ 9″?

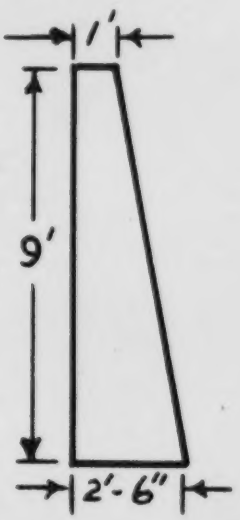


Fig. B
Section View

4. Find the number of cu. yds. in a column whose radius is 1′ and whose height is 21′.

5. Find the number of sq. ft. in the walls and ceiling of a room 21′ long, 14′ wide, and 8′ 6″ high.

6. How many cu. yds. are there in 8 columns 18″ square and 18′ high?

7. How many cu. yds. are there in the following footing and foundation walls?

A	B	C	D	E	F
12″	8′ 8″	43′ 6″	29′	43′ 6″	29′
2′	1′				

8. How many brick laid with a $\frac{3}{8}$″ mortar joint are needed for the foundation walls in problem 7?

9. How many cu. yds. of mortar are needed to lay the brick in problem 8?

10. $5\frac{2}{3}\%$ of 24,440 = ?

11. How many tons of marble veneer are needed to veneer the foundation walls in problem 7?

OBJECTIVE: To learn how to compute the number of cubic yards of concrete needed for sidewalks, basement floors, and patios.

INFORMATION:

In square measure, you learned to find areas of different shaped surfaces. Floors, walks, and patios are surfaces which have depth. To find the number of cubic yards of concrete needed for a floor, walk, or patio, you must first find the area of the surface to be covered, then multiply that area by the specified depth or thickness of the concrete.

The concrete for basement floors, garage floors, walks, and patios is usually 4" thick.

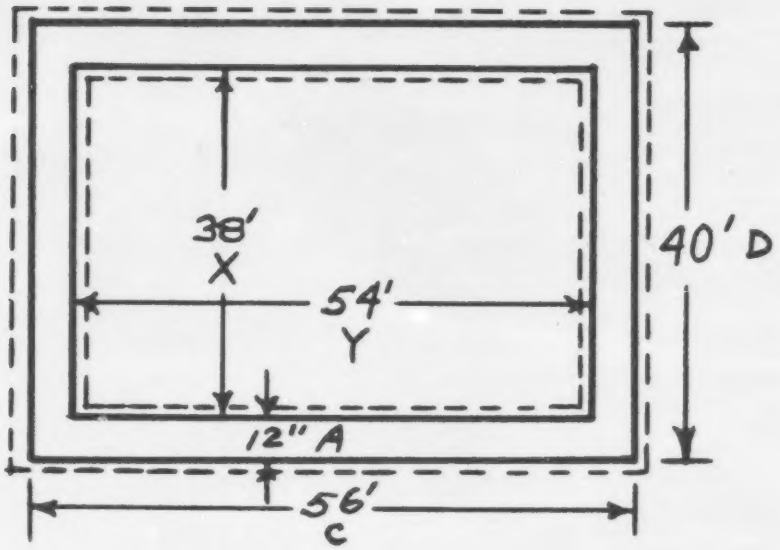
Basement floors are poured inside the walls of a building. On the plan (see Fig. 21) dimensions are always given on the **outside** of the building, as dimensions C and D. The dimensions you need in order to estimate the amount of concrete required are dimensions X and Y. To find dimension X, you subtract the width of the wall from each end of dimension D.

$$X = 40' - (1 + 1) = 38'$$

To find dimension Y, you subtract the width of the wall from each end of dimension C.

$$Y = 56' - (1 + 1) = 54'$$

Y = 54' (length); X = 38' (width)



Note: Floor 4" thick

Fig. 21

To get the area of the floor, multiply the length by the width.

length (Y) 54'
width (X) × 38'
2052 sq. ft. area of floor

To find the number of cu. yds. of concrete needed, multiply the area by the thickness (change 4" to $\frac{1}{3}$ of a foot).
Note that the number of cu. ft. is less than the number of sq. ft.

684
2052 × $\frac{1}{3}$ = 684 cu. ft in floor

Divide by 27 to change the cu. ft. to cu. yds.

$$27\overline{)684} = 25.333$$

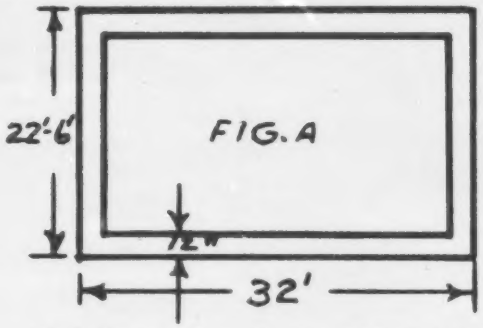
25.3 cu. yds. of concrete needed for the floor of Fig. 21.

Sidewalks and patios cover the entire area given by the dimensions.

Follow the instructions on Information Sheet No. 5. Think before you work; it will save you time and effort.

1. How many cu. yards of concrete are needed for the floor in Fig. A? Floor is 4" thick.

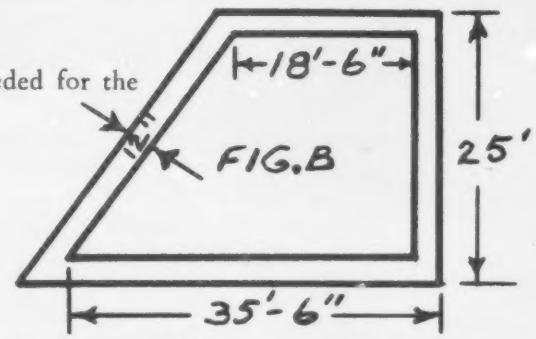
   (Hint: Subtract the width of the walls mentally before you multiply.)



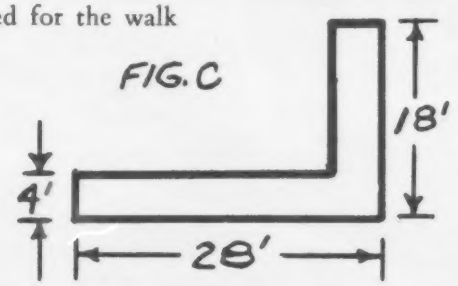
2. How many cubic yards of concrete are needed for a sidewalk 4' wide, 62' 6" long and 4" thick?

3. How many cubic yards of concrete are needed for a patio 23' long, 16' wide, and 4" thick?

4. How many cubic yards of concrete are needed for the floor in Fig. B? Floor is 6" thick.

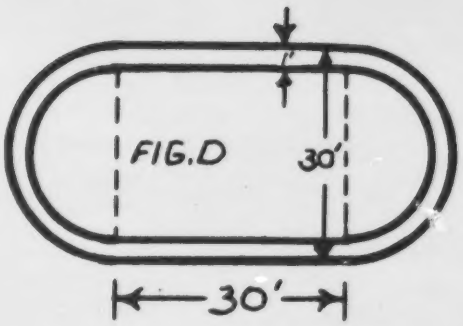


5. How many cubic yards of concrete are needed for the walk in Fig. C? Walk is 4" thick.



6. How many cubic yards of concrete are needed for a patio 29' long, 14' wide, and 4" thick?

7. How many cubic yards of concrete are needed for the floor of Fig. D? Floor is 8″ thick.



8. How many cu. yds. are there in the following footing and foundation walls?

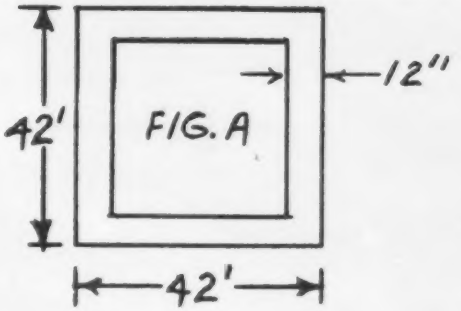
A	B	C	D	E	F
8″	8′ 6″	33′ 2″	27′ 2″	32′ 2″	27′ 2″
1′ 4″	8″				

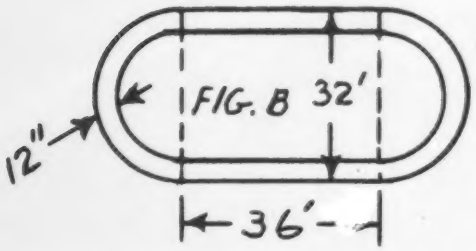
9. How many brick laid with a $\frac{1}{4}$″ mortar joint are needed for the foundation walls in problem 8?

10. How many cubic yards of mortar are needed to lay the brick in problem 9?

11. How many cubic yards of concrete are needed for the floor in problem 8? Floor is 4″ thick.

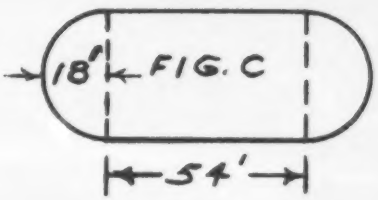
1. How many cu. yds. of concrete are needed for the floor in Fig. A? Floor is 6" thick.

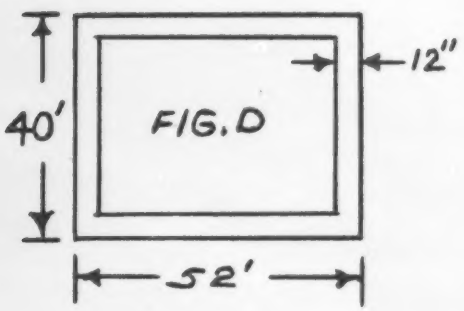




2. How many cu. yds. of concrete are needed for the floor in Fig. B? Floor is 8" thick.

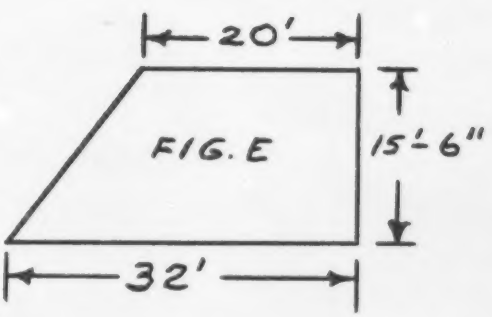
3. How many cu. yds. of concrete are needed for the patio in Fig. C? Concrete is 6" thick.





4. How many cu. yds. of concrete are needed for the floor in Fig. D? Floor is 4" thick.

5. How many cu. yds. of concrete are needed to cover Fig. E? Concrete is 4" thick.



6. How many cu. yds. of concrete are needed for a walk 39′ 9″ long, 4′ 6″ wide, and 4″ thick?

7. How many cu. yds. of concrete are needed for the walk in Fig. F? Walk is 4″ thick.

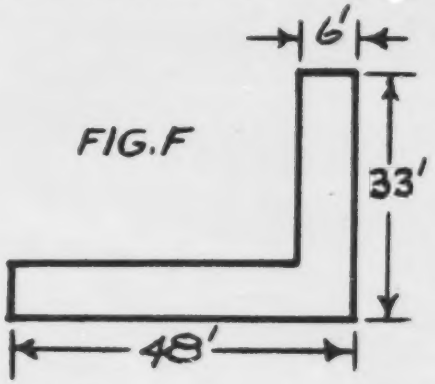


FIG. F

8. How many cu. yds. of concrete are needed for 18 columns 18′ high and 2′ 6″ in diameter?

9. How many sq. ft. are there in the walls and ceiling of a room 26′ 6″ long, 19′ wide, and 9′ 6″ high?

10. How many cu. yds. are there in the following footing and foundation walls?

A	B	C	D	E	F
12″	10′ 6″	67′ 6″	52′	67′ 6″	52′
2′	1′				

11. How many brick laid with a $\frac{5}{8}$″ mortar joint are needed for the foundation walls in problem 10?

12. How many cu. yds. of mortar are needed to lay the brick in problem 11?

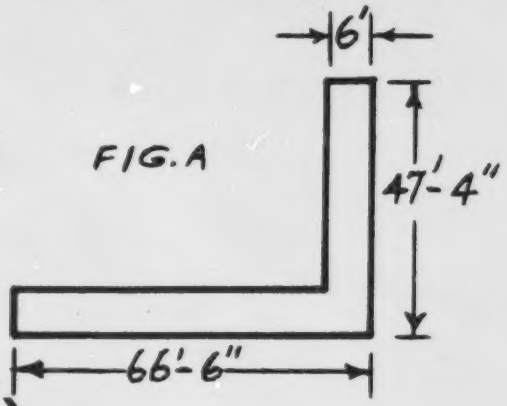
13. How many cu. yds. of concrete are needed for the floor in problem 10? Floor is 4″ thick.

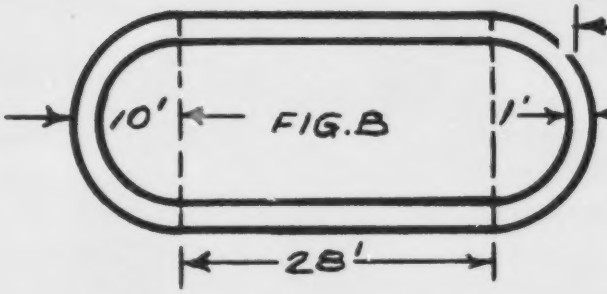
14. How long will it take 16 bricklayers, working 7 hours per day, to lay the brick in problem 11, if they lay an average of 433 brick each per day?

15. How many tons of grained veneer stone are needed for the foundation walls in problem 10?

16. How many sq. ft. of slate are needed to cover the surface of the patio in problem 3?

1. Find the number of cu. yds. of concrete needed for the walk in Fig. A. Walk is 4" thick.



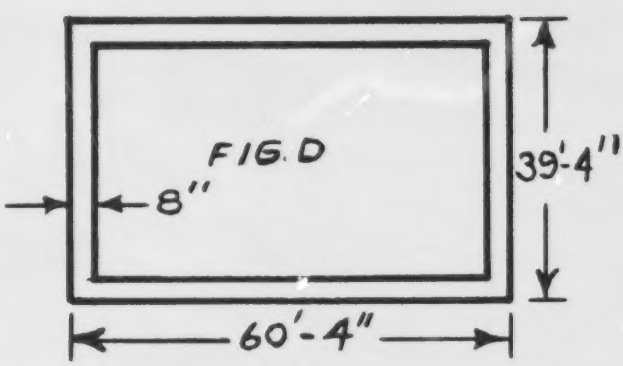


2. How many cu. yds. of concrete are needed for the floor in Fig. B? Floor is 6" thick.

3. How many cu. yds. of concrete are needed for the patio in Fig. C? Concrete is 4" thick.

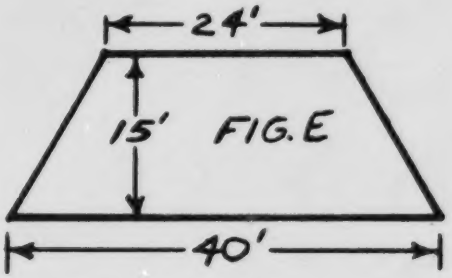
4. How many sq. ft. are there in the walls and ceiling of a room 35' long, 26' wide, and 9' 6" high?

5. How many cu. yds. of concrete are needed for the floor in Fig. D? Floor is 4" thick.



6. How many cu. yds. are there in 18 columns 17′ high and 2′ 9″ in diameter?

7. How many cu. yds. of concrete are needed for the patio in Fig. E? Concrete is 4″ thick.



8. How many cu. yds. are there in the following footing and foundation walls?

A	B	C	D	E	F
12″ and 2′	8′ 4″ and 1′	46′ 6″	58′	46′ 6″	58′

9. How many brick laid with a $\frac{1}{4}$″ mortar joint are needed for the foundation walls in problem 8?

10. How many cu. yds. of mortar are needed to lay the brick in problem 9?

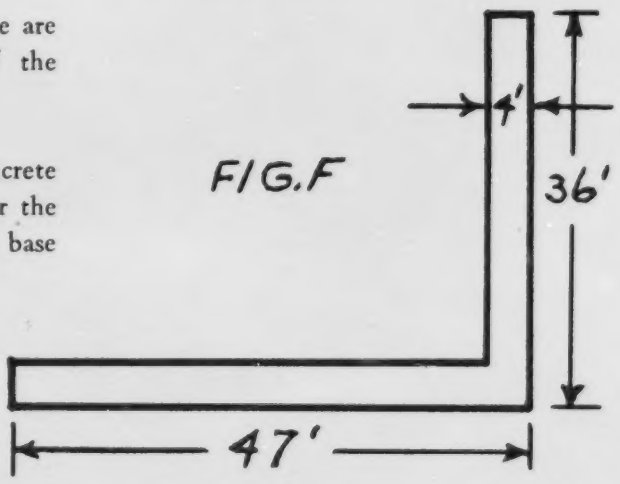
11. How many cu. yds. of concrete are needed for the floor in problem 8? Floor is 6″ thick.

12. $16\frac{2}{3}\%$ of 35,875 = ?

13. How many tons of marble veneer are needed to veneer the foundation walls in problem 8?

14. How many sq. ft. of flagstone are needed for the surface of the walk in Fig. F?

15. How many cu. yds. of concrete are needed for the base under the flagstone in Fig. F? Concrete base is to be 3″ thick.



Now go on to Test No. 10.

Decimal Fractions **Test No. 1-A**

Add:

1. 3.87 + 4.20 + .08 + 6.75 + 367
2. 15 + 1.067 + 22.9 + 640 + 3.45
3. 6400 + 275.60 + 15.48 + 6060 + 35.55

Subtract:

4. 5500 − 4140.32
5. $16.17 − $8.035
6. .0029 − .0007

Multiply:

7. 16.06 X .29
8. .067 X 422
9. 12½% of 6988
10. 5% of 100
11. 1.333 X 78 X 2
12. 150% of 34
13. 1600 X .25 X 2
14. 4.06 X .07 X 6.1

Divide:

15. 34.3 ÷ 3
16. 12.78 ÷ 13
17. 50 is 10% of what number?
18. 18 is 3% of what number
19. 420 ÷ 12.5
20. 990 ÷ 16

Change to decimal fractions:

21. 10%
22. $33\frac{1}{3}\%$
23. 17%
24. 5%
25. 2½%

Change to common fractions:

26. 50%
27. $66\frac{2}{3}\%$
28. $37\frac{1}{2}\%$

Change to common fractions: (cont.)

29. 45%

30. 125%

Change to decimal fractions:

31. $\frac{3}{4}$

32. $\frac{5}{8}$

33 $\frac{1}{6}$

34. $\frac{2}{5}$

35. $\frac{3}{10}$

36. $\frac{1}{3}$

37. $\frac{7}{8}$

38. $\frac{5}{12}$

39. $\frac{11}{12}$

40. $\frac{1}{8}$

Add:

1. 1.620 + 3.57 + .15 + 12.49 + 1.01
2. 1360 + 78.55 + 16.04 + 3400 + 242.9
3. .0025 + .01 + .006 + 1.57 + 2.0008

Subtract:

4. 5050 − 66.42
5. \$58.98 − \$5 39
6. 14.40 − .076

Multiply:

7. 12.24 X 1.3
8. $12\frac{1}{2}\%$ of 16
9. 4.89 X 2.6 X .05
10. 3300 X 1.7 X .45
11. 40% of 1380
12. .083 X 444
13. $5\frac{1}{2}\%$ of 1000
14. 16 X 14 X 22

Divide:

15. 189.6 ÷ 2.4
16. 1502 ÷ .08
17. 13 is 25% of what number?
18. 2000 ÷ 12.8
19. 147.25 is 95% of what number?
20. 15 is $12\frac{1}{2}\%$ of what number?

Change to decimal fractions:

21. 15%
22. 87.5%
23. $5\frac{1}{4}\%$
24. 16.7%
25. 125%

Change to common fractions:

26. 25%
27. 90%
28. $33\frac{1}{3}\%$

Change to common fractions: (cont.)

29. $37\frac{1}{2}\%$

30. 93%

Change to decimal fractions:

31. $\frac{1}{4}$

32. $\frac{1}{12}$

33. $\frac{1}{2}$

34. $\frac{1}{8}$

35. $\frac{5}{12}$

36. $\frac{2}{3}$

37. $\frac{7}{8}$

38. $\frac{1}{6}$

39. $\frac{3}{16}$

40. $\frac{3}{8}$

Addition and Subtraction of Fractions **Test No. 2-A**

When using decimals, give your answer correct to the nearest whole inch.

Add:

1. $275' \; 6\frac{1}{4}'' + 1' \; 11\frac{3}{8}'' + 72' \; \frac{1}{2}''$
2. $115' \; \frac{3}{8}'' + 29' \; 6\frac{1}{4}'' + 8\frac{3}{4}''$
3. $121' \; \frac{3}{4}'' + 8\frac{7}{8}'' + 10' + 41' \; 11\frac{3}{8}''$
4. $196' \; 7\frac{7}{8}'' + 7' + 132' \; \frac{1}{2}'' + 8\frac{1}{2}''$
5. $18' \; \frac{1}{4}'' + 21' \; 10\frac{3}{4}'' + 155' \; 2\frac{7}{8}''$
6. $121' \; \frac{3}{4}'' + 10\frac{3}{8}'' + 41' \; 11'' + 6' \; \frac{1}{2}''$
7. $199' \; 11\frac{7}{8}'' + 16' \; \frac{1}{2}'' + 101' \; 9\frac{3}{4}'' + 8\frac{11}{16}''$
8. $122' \; \frac{1}{2}'' + 71' \; 9\frac{3}{4}'' + 8' \; 11\frac{7}{8}'' + 45' \; 8\frac{9}{16}''$

Subtract:

9. $1{,}895' \; 9\frac{3}{8}'' - 1{,}599' \; 10\frac{3}{4}'' =$
10. $1{,}435' \; 11\frac{1}{2}'' - 396' \; 10\frac{5}{8}'' =$
11. $165' \; \frac{3}{8}'' - 156' \; 10\frac{9}{16}'' =$
12. $271' - 159' \; 9\frac{3}{4}'' =$
13. $194' \; 11'' - 95' \; \frac{1}{2}'' =$
14. $3{,}795' \; 2\frac{1}{4}'' - 2{,}694' \; 2\frac{5}{8}'' =$
15. $3{,}689' \; 11\frac{7}{16}'' - 1{,}792' \; 4\frac{5}{8}'' =$
16. $1{,}435' \; \frac{1}{2}'' - 396' \; 10\frac{5}{8}'' =$

When using decimals, give your answer correct to the nearest whole inch.

Add:

1. $41' \ 2\frac{3}{4}'' + 9\frac{1}{8}'' + 121' + 23' \ 11\frac{7}{8}''$
2. $42' \ 8\frac{3}{4}'' + 100' + 6\frac{7}{8}'' + 7' \ 11''$
3. $245' \ 6\frac{1}{4}'' + 11' \ 11\frac{3}{8}'' + 8\frac{1}{2}'' + 72' \ \frac{1}{2}''$
4. $123' \ 6\frac{3}{4}'' + 45' + 8' \ \frac{7}{8}'' + 8\frac{3}{4}''$
5. $7' \ 5\frac{3}{4}'' + 18' \ \frac{7}{8}'' + 11\frac{1}{2}'' + 45' \ 10''$
6. $132' \ \frac{1}{2}'' + 8\frac{1}{2}'' + 7' + 196' \ 7\frac{7}{8}'' + 17' \ \frac{3}{4}'' =$
7. $41 \ 11\frac{9}{16}'' + 21' + 110' \ \frac{3}{4}'' + 8\frac{7}{8}'' + 8' \ \frac{1}{2}'' =$
8. $155' \ 2\frac{7}{8}'' + 11\frac{5}{8}'' + 34' + 18' \ \frac{9}{16}'' + 21' \ 10\frac{3}{4}'' =$

Subtract:

9. $2{,}279' \ \frac{3}{8}'' - 1{,}378' \ 6\frac{3}{8}'' =$
10. $1{,}895' \ 10\frac{1}{4}'' - 796' \ 11\frac{7}{8}'' =$
11. $559' \ 6'' - 359' \ 7\frac{3}{8}'' =$
12. $191' - 159' \ 9\frac{3}{4}'' =$
13. $156' \ \frac{3}{4}'' - 49' \ 10\frac{7}{8}'' =$
14. $335' \ \frac{1}{2}'' - 316' \ 8'' =$
15. $189' \ 3\frac{3}{16}'' - 92' \ 8\frac{1}{8}'' =$
16. $875' \ 11\frac{3}{4}'' - 687' \ 7\frac{13}{16}'' =$

If you use decimals, give your answers correct to the nearest whole inch (1 & 2) and to a tenth of a square foot (3 & 4).

Add:

1. $9\frac{5}{8}''$ + $115'\ \frac{1}{8}''$ + $7'\ 10\frac{3}{4}''$ + $4'\ \frac{9}{16}''$ =

Subtract:

2. $298'\ 7\frac{7}{8}''$ − $198'\ 6\frac{1}{2}''$ =

Multiply:

3. $66'\ 8''$ × $17'\ 3''$ =

4. $29'$ × $27'\ 4''$ =

5. Nine laborers worked 7 days each, 7 hours per day, and earned $7.45 per hour. How much was the total payroll?

6. Fourteen bricklayers worked 6 days each, 7 hours per day, and laid 64,092 brick. How many brick did each worker average per hour?

7. A builder put up a wall for $22,500. Labor cost $9,765.50 and the overhead came to $1,869.50. Materials cost the following: 23,500 brick @ $172.50 per 1,000; 275 bags of mortar cement @ $2.80 per bag; and 19 tons of sand @ $5.95 per ton. How much did the builder make?

8. If it takes $6\frac{1}{2}$ brick to cover 1 sq. ft. of wall, how many brick are needed for a wall 185' long and 9' high?

If you use decimals, give your answers correct to the nearest whole inch (1 & 2) and to a tenth of a square foot (3 & 4).

Add:

1. $229' \ 8'' + 1\frac{3}{4}'' + 17' + 125' \ 8\frac{1}{2}'' =$

Subtract:

2. $234' \ \frac{5}{8}'' - 133' \ 3\frac{1}{2}'' =$

Multiply:

3. $47' \ 8'' \times 39' \ 9'' =$

4. $23' \times 18' \ 8'' =$

5. Nine laborers worked 8 days each, 7 hours per day and earned a total of $3,402.00. How much did each person earn per hour?

6. Seven workers laying brick averaged 117 brick each per hour. How many brick did they lay in 7 days, working 8 hours per day?

7. A builder put up a wall for $19,800. Labor cost $8,763.55 and the overhead was $1,383.25. Materials cost the following: 22,500 brick @ $139.00 per 1,000; 279 bags of mortar cement @ $2.80 per bag; and 21 tons of sand @ $6.15 per ton. How much did the builder make?

8. If it takes $6\frac{1}{2}$ brick to cover 1 sq. ft. of wall, how many brick are needed for a wall 173' long and 7' high?

Add:

1. $115' \ \frac{3}{8}'' + 29' \ 6\frac{1}{4}'' + 8\frac{1}{4}'' + 140' \ \frac{5}{8}'' + 56' \ 9\frac{1}{2}'' =$
2. $159' \ \frac{3}{4}'' + 7\frac{5}{8}'' + 81' \ 6\frac{5}{8}'' + 265' \ 4\frac{1}{4}'' + 2' \ \frac{1}{2}'' =$

Subtract:

3. $3{,}795' \ 4\frac{1}{4}'' - 2{,}694' \ 4\frac{5}{8}'' =$
4. $1{,}286' \ 3'' - 285' \ 4\frac{3}{4}'' =$

Multiply:

5. $19' \ 3'' \times 18' \ 4'' =$
6. $18' \ 4'' \times 17' \ 8'' =$
7. $39' \ 3'' \times 18' \ 9'' =$

8. Nine masons worked 8 days each, 7 hours per day, and earned a total of $5,922.00. How much did each worker earn per hour?

9. A builder put up a foundation for $23,400. Labor cost $11,896.25 and the overhead was $2,679.45. Materials cost the following: 32,500 brick @ $15.85 per 1,000; 1,250 blocks @ .42 each; 289 bags of mortar cement @ $2.80 per bag; and 30 tons of sand @ $6.25 per ton. How much did the builder make?

10. It takes $6\frac{1}{2}$ brick to face 1 sq. ft. of wall. How many brick are needed to face a wall 298' 6" long and 8' 6" high?

Add:

1. $125' \ 6\frac{3}{4}'' + 27' \ 2\frac{1}{8}'' + 4' \ \frac{1}{2}'' + 133' \ 11\frac{1}{4}''$
2. $350' \ 5\frac{1}{2}'' + 35' \ 6\frac{3}{4}'' + 21' \ 11\frac{3}{8}'' + 131' \ \frac{1}{2}''$

Subtract:

3. $385' \ 6\frac{1}{4}'' - 279' \ 8\frac{5}{8}'' =$
4. $1{,}784' \ \frac{1}{2}'' - 998' \ 4\frac{7}{8}'' =$

Multiply:

5. $48' \ 8'' \times 29' \ 9'' =$
6. $96' \ 4'' \times 32' \ 3'' =$
7. $33' \ 4'' \times 28' \ 9'' =$
8. It takes $6\frac{3}{4}$ brick to face 1 sq. ft. of wall. How many brick are needed to face a wall 319′ long and 8′ 6″ high?
9. A builder put up a foundation for $28,900. Labor cost $11,013.65 and the overhead came to $2,895.75. Materials cost the following: 27 cu. yds. of concrete @ $30.50 per yard; 34,500 brick @ $135.40 per 1,000; 1,900 block @ .45 each; 269 bags of mortar cement @ $2.85 per bag; and 29 tons of sand @ $5.95 per ton. How much did the builder make?
10. What is the price of an I-beam 27′ 6″ long, which weighs $37\frac{1}{4}$ lbs. per lineal foot and costs 24.3¢ per lb.?

Add:

1. $4' \ 6\frac{1}{8}'' + 12' \ 8'' + 7' \ \frac{1}{2}'' + 33' \ 6\frac{1}{4}'' =$

2. $14' + 112' \ 6'' + 8' \ 9\frac{3}{8}'' + 8\frac{3}{4}'' =$

Subtract:

3. $155' \ \frac{1}{2}'' - 97' \ 5\frac{3}{8}'' =$

4. $201' \ 9\frac{9}{16}'' - 102' \ 5\frac{3}{8}'' =$

Multiply:

5. $19' \times 29' \ 3'' =$

6. $18' \ 3'' \times 42' \ 8'' =$

Divide:

7. $21' \ 4'' \div 8 =$

8. $9' \ 6'' \div 1\frac{1}{2} =$

9. $307\frac{1}{2}$ sq. ft. $\div 9 =$

10. $1{,}019\frac{1}{4}$ cu. ft. $\div 27 =$

11. A contractor built a foundation for $16,000. Labor cost $4,248.65 and the overhead came to $2,105.75. Materials cost the following: 25,000 brick @ $125.00 per 1,000; 175 bags of mortar cement @ $2.80 per bag; 15 tons of sand @ $6.25 per ton; and 69 cu. yds. of concrete @ $31.50 per yard. How much did the contractor make?

12. It takes $6\frac{1}{2}$ brick to face 1 sq. ft. of wall. How many brick are needed to face a wall 157' long and 7' high?

Add:

1. $6' \ 6'' + 17' \ \frac{3}{4}'' + 8\frac{3}{8}'' + 36' \ 4\frac{1}{2}'' =$
2. $8\frac{1}{2}'' + 12' \ 3'' + 7' \ \frac{3}{4}'' + 102' \ 11\frac{3}{8}'' =$

Subtract:

3. $175' \ \frac{3}{8}'' - 88' \ 6\frac{1}{2}'' =$
4. $115' \ 3\frac{3}{8}'' - 111' \ 2\frac{9}{16}'' =$

Multiply:

5. $27' \times 37' \ 4'' =$
6. $14' \ 6'' \times 21' \ 9'' =$

Divide:

7. $15' \ 9'' \div 7 =$
8. $16' \ 3'' \div 4\frac{1}{3} =$
9. $717\frac{3}{4}$ sq. ft. $\div 9 =$
10. $1{,}248\frac{3}{4}$ cu. ft. $\div 27 =$

11. A contractor built a foundation for $14,750. Labor cost $3,268.45 and the overhead came to $1,805.75. Materials cost the following: 23,000 brick @ $136.00 per 1,000; 165 bags of mortar cement @ $2.90 per bag; 65 cu. yds. of concrete @ $31.00 per yard; and 15 tons of sand @ $6.25 per ton; How much did the contractor make?

12. It takes $6\frac{1}{2}$ brick to face 1 sq. ft. of wall. How many brick are needed to face a wall 169' long and 7' high?

Addition, Subtraction, Multiplication and Division of Fractions and Decimals — **Test No. 6-A**

Add:

1. $4'\ 4\frac{1}{8}''\ +\ 12'\ 8''\ +\ 7'\ \frac{1}{2}''\ +\ 33'\ 6\frac{1}{4}''\ =$
2. $.5\ +\ 261.058\ +\ 10\ +\ 1.1\ +\ .067\ =$
3. $5\frac{1}{2}\%\ +\ 16\frac{2}{3}\%\ +\ 3\frac{1}{3}\%\ +\ 4\frac{1}{4}\%\ +\ 25\%\ =$

Subtract:

4. $155'\ \frac{1}{2}''\ -\ 97'\ 5\frac{3}{8}''\ =$
5. $16.05\ -\ 9.073\ =$

Multiply:

6. $18'\ 3''\ \times\ 42'\ 8''\ =$
7. $28\frac{3}{4}\ \times\ 7.396\ =$
8. $5\frac{2}{3}\%\ \text{of}\ 26{,}988\ =$

Divide:

9. $9'\ 6''\ \div\ 1\frac{1}{2}\ =$
10. $164.2733\ \div\ 25.39\ =$

Round off to one decimal place:

11. 34.5628
12. 6.8499
13. 201.98
14. 199.965

Change to decimals:

15. 15%
16. $28\frac{1}{2}\%$
17. 6%
18. $4\frac{1}{2}\%$
19. 76%
20. 137%
21. $14\frac{1}{4}\%$
22. $\frac{2}{5}$
23. $\frac{1}{3}$
24. $3\frac{1}{4}\%$
25. $12\frac{1}{2}\%$
26. 200%
27. $\frac{2}{3}$
28. $\frac{1}{2}$
29. $\frac{1}{2}\%$
30. 3%
31. $\frac{7}{8}$
32. 1%

Give the decimal equivalent of:

33. $\frac{1}{8}$
34. $\frac{1}{4}$
35. $\frac{1}{12}$
36. $\frac{1}{6}$
37. $\frac{3}{8}$
38. $\frac{9}{10}$
39. $\frac{3}{4}$
40. $\frac{5}{6}$

Add:

1. $8\frac{1}{2}'' + 12' 3'' + 7' \frac{3}{4}'' + 102' 7'' =$
2. $.005 + 3.2 + 11 + 267.19 + 4.627 =$
3. $5\frac{1}{4}\% + 16\frac{1}{3}\% + 4\% + 3\frac{2}{3}\% + 35\% =$

Subtract:

4. $115' 3\frac{3}{8}'' - 111' 2\frac{1}{2}'' =$
5. $27.03 - 18.246 =$

Multiply:

6. $14' 6'' \times 21' 9'' =$
7. $26\frac{1}{4} \times 8.487 =$
8. $16\frac{2}{3}\%$ of $42.789 =$

Divide:

9. $16' 3'' \div 4\frac{1}{3} =$
10. $210.1248 \div 27.36 =$
11. $620 \div .05 =$

Round these off to the nearest hundredth.

12. 3.1416
13. 222.954
14. 16.0975
15. Twelve seniors were planning to become masons. If this represented 15% of the class, how many seniors were there in all?
16. Compute a year's interest on a government bond of $5,000 at $6\frac{3}{4}\%$.
17. A mason built a house to live in. When it was finished, the mason estimated that it had cost only about 55% of its actual market value. If the market value of the house was $69,000, how much had it actually cost the mason to build?
18. A mason averaged 630 brick per day; the apprentice working with him averaged $\frac{2}{3}$ as many. How many bricks did the two workers lay, working together?
19. How much of a saving is represented by a discount of 3% on materials costing $1428.10?
20. A mason bought a ladder marked $39.98 at a $12\frac{1}{2}\%$ discount. What did it cost? for it?

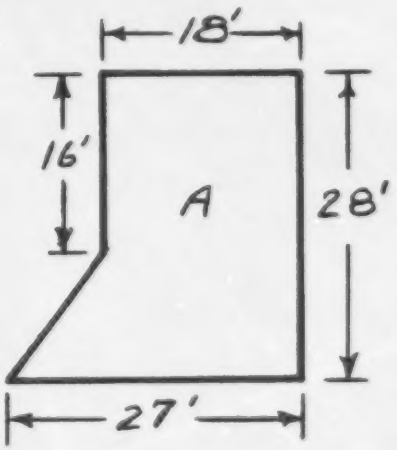
Areas and Perimeters **Test No. 7-A**

1. Find the area of a triangle which has a base 17′ and is 12′ high.
2. Find the area of a circle whose diameter is 27′.
3. Find the perimeter of a 21′ 6″ square.
4. Find the circumference of a circle whose radius is 13′ 4″ (to one decimal place).
5. Find the area of a triangle whose base is 24′ and whose height is 16′.
6. Find the perimeter of a triangle whose base is 24′ and whose height is 16′. The two other sides of the triangle are equal.
7. Find the area of a circle whose circumference is 21.99′ (to one decimal place).

How many sq. ft. are there in the walls and ceilings of rooms having the following dimensions?

	Length	Width	Height
8.	32′ 6″	18′	12′
9.	44′	31′	14′ 6″
10.	82′	46′	15′ 6″

11. Find the area of Fig. A.
12. Find the perimeter of Fig. A.
13. How many courses of brick are needed to build a wall 14′ $2\frac{1}{2}$″ high? The brick are to be laid 4 courses in 11″.



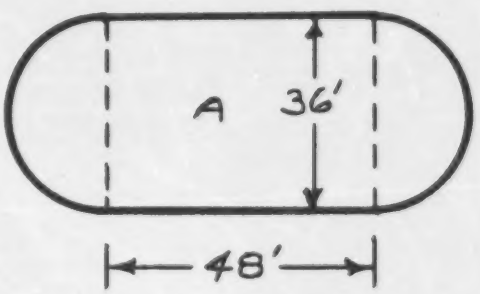
14. How many courses of block are needed to build a wall 29′ $1\frac{3}{8}$″ high? The block are laid in $8\frac{1}{8}$″ for each course.

1. Find the area of a triangle which has a base 19′, and is 14′ high.
2. Find the area of a circle whose diameter is 29′.
3. Find the area of a 23′ 6″ square.
4. Find the circumference of a circle whose radius is 14′ 4″ (to one decimal place).
5. Find the area of a triangle whose base is 15′ and whose height is 10′.
6. A triangle's sides are in the ratio of 3-4-5. If the smallest side is 15′, what is the perimeter of the triangle?
7. Find the area of a circle whose circumference is 18.85 (to one decimal place).

How many sq. ft. are there in the walls and ceilings of rooms having the following dimensions?

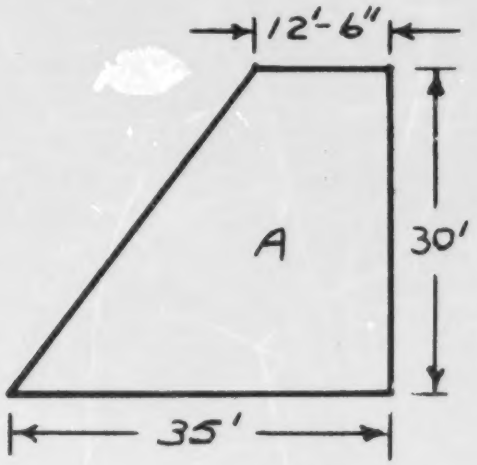
	Length	Width	Height
8.	21′ 6″	18′	10′
9.	17′	13′	8′ 6″
10.	72′	45′ 6″	16′

11. Find the area of Fig. A.
12. Find the perimeter of Fig. A.

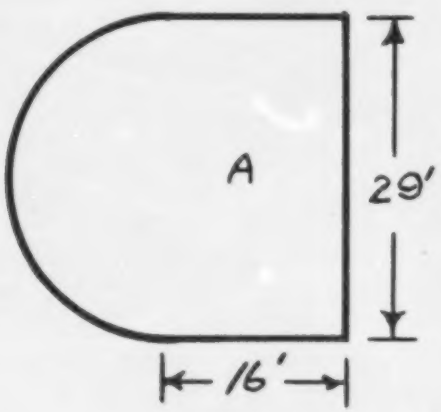


13. How many courses of brick are needed to build a wall 14′ $10\frac{1}{2}$″ high? The brick are to be laid 4 courses in $10\frac{1}{2}$″.
14. How many brick are needed for the first course of a building, 147′ $6\frac{1}{2}$″ long and 106′ 6″ wide? A brick with the cross joint measures $8\frac{3}{8}$″.

1. How many sq. ft. are there in the walls of a room, 37′ 6″ long, 29′ 9″ wide, and 11′ high?
2. Find the area of a triangular prism whose base is 24′, whose height is 16′, and whose length is 37′.
3. What is the area of a rectangular prism, 32′ 6″ long, 17′ wide, 11′ high?
4. It takes $6\frac{3}{4}$ brick to cover 1 sq. ft. of wall. How many brick are needed for a wall 259′ long and 9′ high?
5. Find the area of a 7′ 6″ cube.
6. Find the area of a circle whose diameter is 8.5′
7. Find the area of a cylinder whose diameter is 24′, and whose height is 18′.
8. How many sq. ft. are there in the walls and ceiling of a room 30′ long, 20′ wide, and 9′ 6″ high?
9. Find the area of Fig. A.
10. Find the perimeter of Fig. A.



1. How many sq. ft. are there in the walls of a room 37′ 6″ long, 27′ 6″ wide, and 11′ high?
2. Find the area of a triangular prism whose base is 24′, whose height is 16′, and whose length is 37′ 9″.
3. Find the area of a rectangular prism, 32′ long, 11′wide and 17′ high.
4. It takes $6\frac{1}{4}$ brick to cover 1 sq. ft. of wall. How many brick are needed for a wall 259′ long and 9′ high?
5. Find the area of a 9′ 6″ cube.
6. Find the area of a circle whose radius is 5.25′.
7. Find the area of a cylinder whose diameter is 24′ and whose height is 16′.
8. How many sq. ft. are there in the walls and ceiling of a room 50′ long, 25′ wide, and 12′ 6″ high?
9. Find the area of Fig. A.
10. Find the perimeter of Fig. A.



Quantities of Materials **Test No. 9-A**

1. How many sq. ft. are there in the walls and ceiling of a room 25′ long, 15′ wide, and 9′ high?

How many cu. yds. are there in the following foundation walls?
(Be sure to keep track of the number of cubic feet in each.)

	A	B	C	D	E	F
2.	12″	12′	89′ 6″			
3.	12″	13′ 6″	50′	38′	50′	38′
4.	16″	18′	36′	42′	36′	42′

5. How many brick laid with a $\frac{1}{4}$″ mortar joint are needed to build the foundation walls in problem 3?

6. How many cu. yds. of mortar are needed to lay the brick in problem 5?

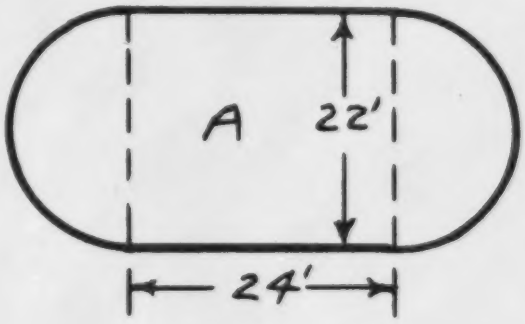
7. Find the area of a rectangular prism 27′ long, 14′ high, and 4′ 6″ wide.

8. Find the area of a cylinder whose diameter is 12′ and whose height is 19′.

9. $5\frac{2}{3}\%$ of 48,762 = ?

10. Find the Area of Fig. A.

11. Find the perimeter of Fig. A.



12. How many tons of marble veneer are needed to veneer the foundation walls in problem 3?

1. How many sq. ft. are in the walls and ceiling of a room 30′ long, 22′ wide, and 11′ high?

How many cu. yds. are there in the following foundation walls?
(Be sure to keep track of the number of cubic feet in each)

	A	B	C	D	E	F
2.	12″	14′	79′ 6″			
3.	12″	11′ 6″	37′	29′	37′	29′
4.	16″	15′	38′ 8″	45′	38′ 8″	45′

5. How many brick laid with a $\frac{1}{2}$″ mortar joint are needed to build the foundation walls in problem 3?

6. How many cu. yds. of mortar are needed to lay the brick in problem 3?

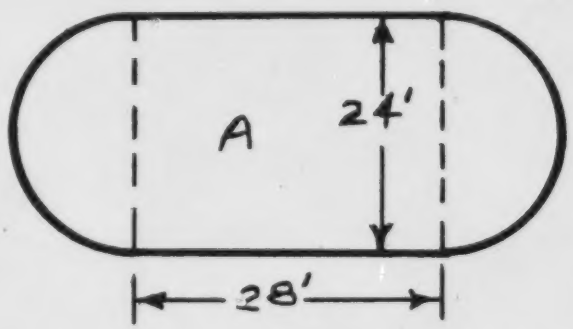
7. Find the area of a triangular prism whose base is 18′, height is 12′, and length is 29′ 9″.

8. Find the area of a cylinder whose diameter is 6′ and whose height is 18′.

9. $16\frac{2}{3}\%$ of 27,968 = ?

10. Find the area of Fig. A.

11. Find the perimeter of Fig. A.



12. How many tons of grained stone veneer are needed to veneer the foundation walls in problem 3?

1. How many sq. ft. are there in the walls and ceiling of a room 18′ 6″ long, 14′ wide, and 10′ high?
2. Find the number of cu. yds. in 12 columns, 2′ in diameter and 17′ 6″ high.
3. How many cu. yds. are there in a slanted wall which is 79′ 6″ long? See section view, Fig. A, for width and height.

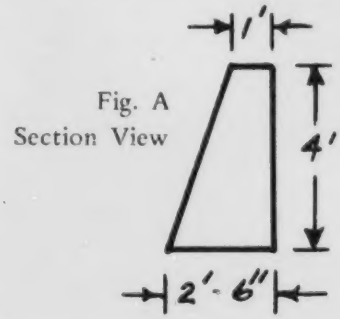
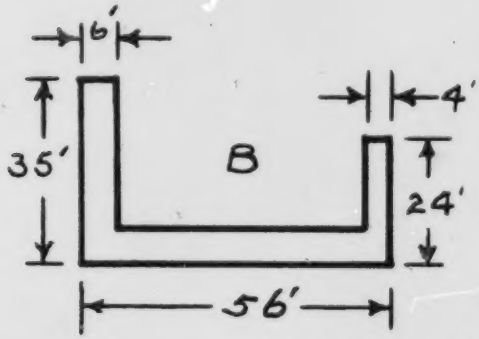
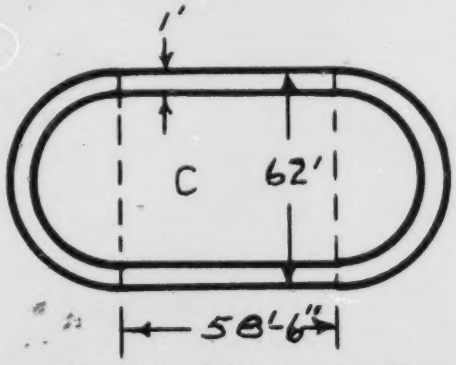


Fig. A
Section View



4. How many cu. yds. of concrete are needed for the walk, Fig. B? Walk is 4″ thick.

5. How many cu. yds. of concrete are needed for the floor of Fig. C? Concrete is 6″ thick.



6. How many cu. yds. are there in the following footing and foundation walls?

A	B	C	D	E	F
12″ by 2′	8′ 6″ by 1′	43′ 6″	71′ 6″	43′ 6″	71′ 6″

7. How many brick laid with a $\frac{1}{2}$″ mortar joint are needed for the foundation walls in problem 6?
8. How many cu. yds. of mortar are needed to lay the brick in problem 7?

9. How many cu. yds. of concrete are needed for the floor in problem 6? Floor is 6" thick.

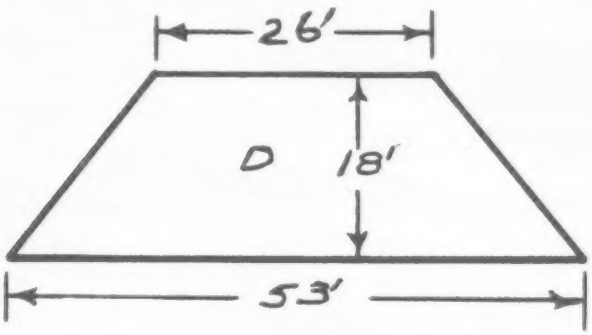
10. How many tons of grained stone veneer are needed to veneer the foundation walls in problem 6?

11. Find the area of a cylinder 3' in diameter and 16' 6" high.

12. How many cu. yds. of concrete are needed for 18 columns 18" square and 16' high?

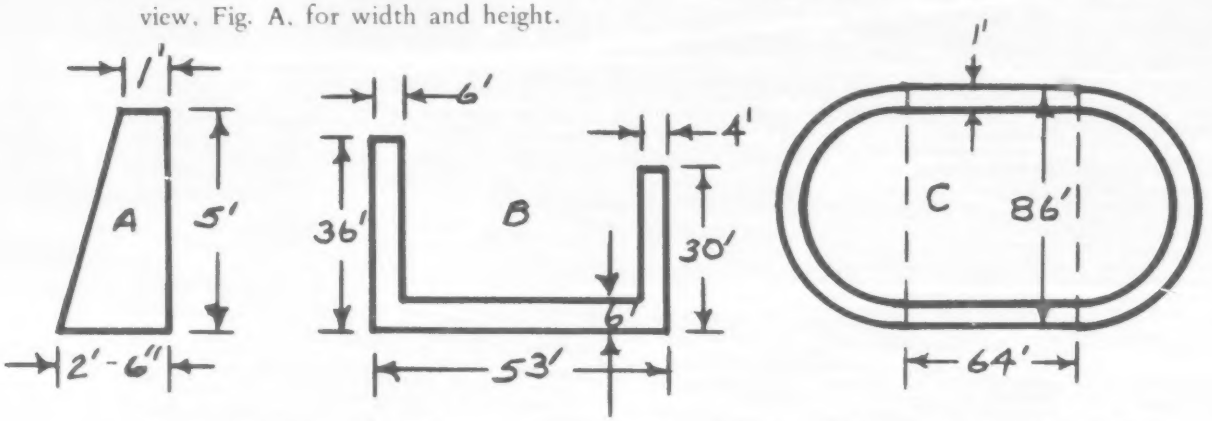
13. How many cu. yds. of concrete are needed for the patio in Fig. D? Concrete is 4" thick.

14. Find the perimeter of Fig. D.



15. How many days will it take 6 bricklayers to lay the brick in problem 7, if they work 7 hours per day and lay an average of $56\frac{1}{2}$ brick each per hour? Give the answer to the nearest half or full day.

1. How many sq. ft. are there in the walls and ceiling of a room 29′ long, 21′ wide, and 12′ 6″ high?
2. Find the number of cu. yds. in 12 columns, 4′ in diameter and 17′ 6″ high.
3. How many cu. yds. are there in a slanted wall which is 89′ 6″ long? See section view, Fig. A, for width and height.



4. How many cu. yds. of concrete are needed for the walk, Fig. B? Walk is 4″ thick.
5. How many cu. yds. of concrete are needed for the floor of Fig. C? Concrete is 8″ thick.
6. How many cu. yds. are there in the following footing and foundation walls?

A	B	C	D	E	F
12″	9′ 6″	54′ 9″	61′ 9″	54′ 9″	61′ 9″
2′	1′				

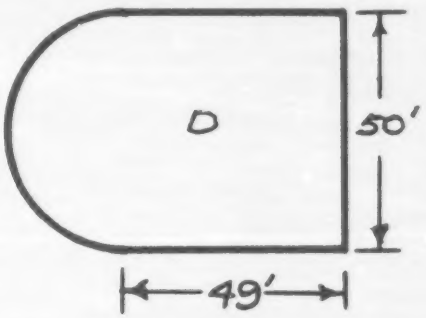
7. How many brick laid with a $\frac{1}{2}$″ mortar joint are needed for the foundation walls in problem 6?
8. How many cu. yds. of mortar are needed to lay the brick in problem 7?
9. How many cu. yds. of concrete are needed for the floor in problem 6? Floor is 6″ thick.
10. How many tons of marble veneer are needed to veneer the foundation walls in problem 6?

11. Find the area of a cylinder 6′ in diameter and 16′ 6″ high.

12. How many cu. yds. of concrete are needed for 24 columns 18″ square and 16′ high?

13. How many cu. yds. of concrete are needed for the patio in Fig. D? Concrete is 4″ thick.

14. Find the perimeter of Fig. D.



15. How many days will it take 7 bricklayers to lay the brick in problem 7, if they work 7 hours per day and lay an average of $57\frac{1}{2}$ brick each per hour? Give the answer to the nearest half or full day.